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REPORT

ON THE

DANISH OCEANOGRAPHICAL EXPEDITIONS 1908-1910

TO THE

MEDITERRANEAN AND ADJACENT SEAS

PUBLISHED AT THE COST OF THE CARLSBERG FUND

UNDER THE SUPERINTENDENCE OF

JOHS. SCHMIDT, PH. D.
DIRECTOR OF THE CARLSBERG PHYSIOLOGICAL LABORATORY, COPENHAGEN,
MEMBER OF THE DANISH COMMITTEE FOR THE STUDY OF THE SEA,
LEADER OF THE EXPEDITIONS

N° 10

VOL. II (Biology), A. 13: Sudidæ (Paralepis) by VILH. EGE.
— - — A. 14: Carangidæ by W. SCHNAKENBECK.
— III (Miscellaneous Papers), 6: Nitrate and Phosphate contents of Mediterranean water by HELGE THOMSEN.
— - — — 7: Some quantitative investigations on the bottom fauna at the west coast of Italy, in the Bay of Algiers, and at the coast of Portugal by R. SPÄRCK.

COPENHAGEN
ANDR. FRED. HØST & SØN
PRINTED BY BIANCO LUNO A/S

1931

List of Papers resulting in whole or in part from the Cruises of the Danish Research-Steamer "Thor" in the Atlantic and Mediterranean.

1. Hydrography.

J. P. JACOBSEN, in Schmidt, Nielsen og Jacobsen: Fra den danske oceanografiske Expedition til Middelhavet i Vinteren 1908—1909. (Geografisk Tidsskrift, 20. H. VI, København 1910).

MARTIN KNUDSEN: Danish Hydrographical Investigations at the Faroe Islands in the Spring of 1910. (Meddelelser fra Kommissionen for Havundersøgelser, Serie: Hydrografi, II, No. 1, København 1911.

J. N. NIELSEN: Hydrography of the Waters by the Faroe Islands and Iceland during the cruises of the Danish research-steamer "Thor" in the summer 1903 (ibid. I, No. 4, 1904).

— Contributions to the Hydrography of the Waters north of Iceland (ibid. I, No. 7, 1905).

— Contribution to the Hydrography of the north-eastern part of the Atlantic Ocean (ibid. I, No. 9, 1907).

— Contribution to the understanding of the currents in the northern part of the Atlantic Ocean (ibid. I, No. 11, 1908).

— in Schmidt, Nielsen og Jacobsen: Fra den danske oceanografiske Expedition til Middelhavet i Vinteren 1908—1909 (Geografisk Tidsskrift, 20, H. VI, København 1910).

— Sur les températures des grandes profondeurs particulièrement dans la Méditerranée, Note préliminaire, (Bulletin de l'Institut Océanographique, No. 209, Monaco 1911).

— Hydrografiske Undersøgelser i Middelhavet; De danske oceanografiske Expeditioner i 1908—1910, København 1913.

Numerous observations, sections, etc. from the "Thor" Expeditions in the Atlantic have been published in: Bulletin Hydrographique du Conseil Permanent International pour l'Exploration de la Mer, København 1902 and following years.

2. Biology.

VILH. EGE: On the postlarval stages of the species of *Paralepis* inhabiting the North Eastern part of the Atlantic incl. the Mediterranean (Videnskabelige Meddelelser fra Dansk naturhistorisk Forening, Vol. 69, København 1918).

P. JESPERSEN: Contributions to the Life-History of the North Atlantic Halibut (*Hippoglossus vulgaris* Flem.) (Meddelelser fra Kommissionen for Havundersøgelser, Serie: Fiskeri, Bind V, No. 5, København 1917).

— On the Occurrence of the Postlarval Stages of the Herring and the "Lodde" (*Clupea harengus* L, and *Mallotus villosus* O. F. M.) at Iceland and the Færoes, (ibid. Bind VI, No. 1, 1920).

P. JESPERSEN and A. VEDEL TÅNING: Some Mediterranean and Atlantic *Sternoptychidae*. (Videnskabelige Meddelelser fra Dansk naturhistorisk Forening, Vol. 70, København 1919).

C. H. OSTENFELD: *Thorosphaera*, eine neue Gattung der Coccolithophoriden (Berichte der deutschen Botanischen Gesellschaft, Bd. 28, Berlin 1910).

OVE PAULSEN: Plankton-Investigations in the Waters round Iceland in 1903 (Meddelelser fra Kommissionen for Havundersøgelser, Serie: Plankton, I, No. 1, København 1904).

— On some Peridineae and Planktons Diatoms (ibid. I, No. 3, 1905).

— Studies on the biology of *Calanus finmarchicus* in the waters round Iceland (ibid. I, No. 4, 1906).

— Plankton Investigations in the Waters round Iceland and in the North Atlantic in 1904 (ibid. I, No. 8, 1909).

— The plankton on a submarine bank (in Biologiske Arbejder tilegnede Eug. Warming d. 3. Nov. 1911, København 1911).

C. G. JOH. PETERSEN: On the Larval and Postlarval Stages of the Long Rough Dab and the Genus *Pleuronectes* (Meddelelser fra Kommissionen for Havundersøgelser, Serie: Fiskeri, I, No. 1, København 1904).

C. G. JOH. PETERSEN: Larval Eels *(Leptocephalus brevirostris)* of the Atlantic Coasts of Europe (ibid. I, No. 5, 1905).

— On the young stages of the Genus *Zeugopterus* (Report of the Danish Biological Station, XII, København 1905).

— On the Larval and Post-Larval Stages of some *Pleuronectidae (Pleuronectes, Zeugopterus)* (Meddelelser fra Kommissionen for Havundersøgelser, Serie: Fiskeri, II, No. 1, København 1906).

— On the Larval and Postlarval Stages of some *Pleuronectidae (Zeugopterus, Arnoglossus, Solea)* (ibid. III. No. 1, 1909).

LOUIS ROULE: Étude sur les formes larvaires Tiluriennes de Poissons Apodes recueillies par le "Thor" (Annales de l'Institut Océanographique, T. VI, Fasc. 2, Monaco 1913).

JOHS. SCHMIDT: Fiskeriundersøgelser ved Island og Færøerne i Sommeren 1903 (Skrifter udgivne af Kommissionen for Havundersøgelser, No. 1. København 1904).

— On Pelagic Post-Larval Halibut *(Hippoglossus vulgaris* Flem. and *H. hippoglossoïdes* [Walb.]) (Meddelelser fra Kommissionen for Havundersøgelser, Serie: Fiskeri, I, No. 3, København 1904).

— The Pelagic Post-Larval Stages of the Atlantic Species of *Gadus*, Part I (ibid. I, No. 4, 1905).

— On the Larval and Post-Larval Stages of the Torsk (*Brosmius brosme* [Ascan.]) (ibid. I, No. 8. 1905).

— The Pelagic Post-Larval Stages of the Atlantic Species of *Gadus*, Part II, (ibid. II, No. 2, 1906).

— On the Pelagic Post-Larval Stages of the Lings (*Molva molva* [Linné] and *Molva byrkelange* [Walb.]) (ibid. II, No. 3, 1906).

— On the Larval and Post-Larval Development of the Argentines (*Argentina silus* [Ascan.] and *Argentina sphyræna* Linné with notes on *Mallotus villosus* [O. F. Müll.]) (ibid. II, No. 4, 1906).

— Contribution to the Life-History of the Eel (*Anguilla vulgaris* Turt.) (Rapports et Procès-Verbaux du Conseil International pour l'Exploration de la Mer, Vol. V, No. 4, København 1906).

— Marking Experiments on Plaice and Cod in Icelandic Waters (Meddelelser fra Kommissionen for Havundersøgelser, Serie: Fiskeri, II, No. 6, København 1907).

— On the Post-Larval Development of the Hake (*Merluccius vulgaris* Flem.) (ibid. II, No. 7, 1907).

— On the Post-Larval Development of some North Atlantic Gadoids (*Raniceps raninus* [Linné] and *Molva elongata* [Risso]) (ibid. II, No. 8, 1907).

— On the Post-Larval Stages of the John Dory (*Zeus faber* L.) and some other Acanthopterygian Fishes (ibid. II, No. 9. 1908).

— Remarks on the Metamorphosis and Distribution of the Larvae of the Eel (*Anguilla vulgaris* Turt.) (ibid. III, No. 3, 1909).

— On the Occurrence of Leptocephali (Larval Muraenoids) in the Atlantic W. of Europe (ibid. III, No. 6, 1909.

— On the Distribution of the Fresh-Water Eels (*Anguilla*) throughout the World, I. Atlantic Ocean and Adjacent Regions (ibid. III, No. 7, 1909).

— The Distribution of the Pelagic Fry and the Spawning Regions of the Gadoids in the North Atlantic from Iceland to Spain (Rapports et Procès-Verbaux du Conseil International pour l'Exploration de la Mer, Vol. X, No. 4, København 1909).

— Exposé sommaire des travaux de l'expédition océanographique danoise dans la Méditerranée (1908—1909) (La Géographie, XXI, 2, Paris 1910).

— *Leptocephalus hyoproroïdes* and *Lept. thorianus* (Zoologischer Anzeiger, XXXVI, No. 2—3, Leipzig 1910).

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VOL. II: BIOLOGY. VOL. III: MISCELLANEOUS PAPERS

COPENHAGEN
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TO THE MEDITERRANEAN AND ADJACENT SEAS

Vol. II. Biology.

A. 13.

Sudidæ

(Paralepis)

by

Vilh. Ege.

With 37 figures and charts in the text.

Published December 15, 1930.

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I. INTRODUCTION.

The present work, an investigation of the species of the pelagic fish genus *Paralepis* inhabiting the North Atlantic, including the Mediterranean, was originally designed as a working up of the material procured by the Danish Oceanographical Expeditions to the Mediterranean and Adjacent Seas in 1908—10. A preliminary investigation of this showed, however, several interesting facts from both a systematical and biological point of view, the deeper knowledge and understanding of which it would not be possible to attain by means of the Mediterranean material alone. At that time a fairly large material of the northern forms of the genus in question was at hand, collected during the cruises of the "Thor" in 1904—06, particularly in the waters south-west of Ireland (bounded on the west by about 15° W. long.) and in the Bay of Biscay, a material fairly valuable for my special purpose, a comparison between the said area and the Mediterranean.

This investigation was, however, for different reasons interrupted for several years, and before an opportunity to resume it occurred, there came to hand the comprehensive material which, for one thing, was the result of the intensive investigation of the southern portion of the North Atlantic undertaken by the four expeditions, the cruise of the "Margrethe" in 1913, the cruises of the M/S "Dana" in 1920 and 1921 and the cruise of the R/S "Dana" in 1921—22, supplemented with collections made from several other vessels. It was only natural to include this particularly extensive material in the investigation, especially as the most interesting or at any rate, from a biological point of view, the most specialized species of the Mediterranean was not represented in the above mentioned material from the Atlantic.

The entire material consists of 13.576 specimens. This number is, to be sure, unequally divided among the several species, but, as regards most of them, the material has been practicable and, in some instances, particularly suitable for biological investigations.

With but extremely few exceptions the specimens are postlarvæ at very different stages, which stages, as regards the species previously described, with the exception of those of an individual species, had not been identified with certainty, most of them were unknown. This circumstance, in connection with the uncertainty that prevailed with regard to the inter-systematical demarcation of the several forms, necessitated a similar morphological and systematical scrutiny of the previously described species as of the new.

This work, then, is the result of two different kinds of investigation, a systematical and a biological, which have not only the mutual connection that the former is an assumption of the latter, but which together form a harmonious whole, as the mutual divergences of the different closely related forms, in a biological and geographical respect, can be used as the touch stone for the value of the differences of character which underlie the comprehension of the systematical relation between them.

For the systematical investigation, the material of the Danish expeditions was insufficient, particularly on account of its lack of adult specimens; thanks to the kind courtesy of different museum authorities, I was, however, able to supplement it with a, of not large yet satisfactory, material of such specimens. In this connection I beg to offer my sincere thanks to:— Prof. Ad. S. Jensen (Københavns Universitets Zoolo-

giske Museum), Prof. L. A. JÄGERSKIÖLD (Göteborg Naturhistoriska Museum), Dr. J. R. NORMAN and Dr. C. TATE REGAN, Director (British Museum), Dr. J. RICHARD (Musée Océanographique Monaco), Dr. B. SÆMUNDSSON (Natural History Collection at Reykjavik) and Dr. A. WETMORE, Secretary (U. S. National Museum).

Furthermore I wish to thank Prof. JOHS. SCHMIDT for his liberality in placing the large material, resulting from the Danish Oceanographical Expeditions, at my disposal.

The work has been carried out at the Physiological Department of the Carlsberg Laboratory.

All the figures have been drawn by the author.

II. SYSTEMATICAL AND MORPHOLOGICAL INVESTIGATIONS.

A. SYNOPSIS OF THE SPECIES.

Most of the authors of the last half century (from BELLOTTI, 1877 to PARR, 1928) place *Sudis*, the genus described by RAFINESQUE in 1810, together with the genus *Paralepis*, the former established on the basis of the species *Sudis hyalina*, which, by the way, is the only one within the range of the present investigation that has hitherto been described. The difference between the two genera is generally represented to consist exclusively in the different form of the teeth in the lower jaw, in accordance with which opinion the maintenance of the two genera is not considered to be sufficiently warranted.

All the investigated species of *Paralepis*, however different they may be, show, nevertheless, a common agreement in certain respects which contrasts *Sudis hyalina* with them all.

In the first place, as regards the dentition, the difference is greater than what, as a rule, is stated, that the teeth in the lower jaw of a *Sudis* are triangular, compressed, with jagged edges and of equal length, while those of a *Paralepis* are round, slender, smoothly edged and, if there are any long teeth at all, always accompanied by smaller teeth of the same shape. As RAFINESQUE and, later on, BONAPARTE (1832—41) have already pointed out, a more essential difference exists with regard to the dentition of the palatines which in all species of *Paralepis*, at any rate partly, consists of round, slender teeth of a similar length to those in the lower jaw, while the same in a *Sudis* is lacking or (in younger specimens) consists of very small teeth.

Besides this there is a circumstance which in reality renders *Sudis hyalina* fairly isolated, namely that the number of rays in the dorsal fin of this form is 14—15, whereas within the range of all the investigated species of *Paralepis* only 9—12 rays are found, and even of these four figures the two extremes very seldom occur. The fact, that only so slight a difference with regard to this character exists among the species which in other respects, *e. g.* the number of rays in the anal fin, are very inter-divergent, shows the significance of the above mentioned difference between the two genera.

Finally, the development of the pectoral fins presents an important difference. While these fins in the younger postlarval stages of *Paralepis* are at a very primitive stage, not furnished with rays, and of very slight extent and, in the older postlarval and adolescent stages, have an appearance almost similar to that of adult individuals, those in the corresponding stages of *Sudis* are of considerable extent, being furnished with rays of so great a length that they almost reach the dorsal fin, a circumstance which, as regards the postlarval stages, was pointed out by SANZO (1917), as regards the adolescent, it has already been mentioned by GÜNTHER (1864).

In consequence of these differences there appear to be sufficient reasons for the maintenance of *Sudis* as a separate genus, therefore that (or those) species belonging to that genus has not been included in this investigation.

The relation of the genus *Paralepis* to another genus *Lestidium*, described by GILBERT in 1905, has recently been the object of a mistaken comment which, taking into consideration the *Paralepis* species within the range with which this work deals, has resulted in one of these being transferred to the above mentioned genus. *P. speciosus* Bellotti is by PARR (1928), on account of the lack of scales in the hitherto found specimens of this species, considered to belong to the genus *Lestidium* (though representing a new subgenus of this, called *Bathysudis*). What importance this character, the lack of scales, has as a generic characteristic of *Lestidium* is a matter beyond the scope of the present investigation; but one cannot adopt the alteration made by PARR with regard to the systematical position of *P. speciosus*, as the reasons advanced for it are quite untenable. Nearly all the Mediterranean and North Atlantic species in the material at hand are, for one thing, represented by adolescent specimens and all these specimens are entirely devoid of scales, a formation which consequently does not develop until a late stage, and the lack of which in the younger specimens therefore does not indicate the existence or non-existence of this formation in the really adult individuals. It is a matter of course that the minimum size for the occurrence of the formation of the scales is different in the various species nor does the stage of development appear to be the same. In a specimen of *P. brevis*, 64 mm. in length, PARR has found initiatory scale formation, while a specimen of *P. rissoi rissoi*, in the material at hand, which is 188 mm. in length, has not a trace of scales, not even of those of the lateral line, these latter, however, being very firmly fixed in this genus. These details show conclusively that *P. speciosus*, of which species only younger specimens are known, can hardly differ from the other species as regards the character under consideration.

Reckoning with the three new species represented in the material which forms the basis of this work, there are ten species known from the North Atlantic, including the Mediterranean, if we disregard the *Paralepis*-form described by BRAUER under the name of "*Omosudis elongatus*" and which has not hitherto been found north of $2^1/_2°$ N. lat.

The characters which previous authors have particularly taken into consideration in distinguishing species are, besides the number of fin rays, the length of the head, the dentition, the position of the ventral fins in relation to the dorsal fin, the distance from the anal fin (or adipose fin) to the caudal fin, and the length of the pectoral fins.

The basis of the following synopsis lies, as regards some of the species, in the investigation of adult as well as adolescent specimens, in the case of others, only the adolescent; in judging the relation of the latter, the characters which exhibit the same differences in adult and adolescent individuals have preferably been taken into consideration.

I. The large teeth in the lower jaw are comparatively short or (in adults) missing, their length amounting to as much as 5 % of the length of the snout. The preanal length amounts on an average to a little more than two thirds, in the examined specimens 66—72 %, of the total length exclusive of caudal fin.

A. The small teeth in the premaxillaries are, in the adult specimens, close fitting with the same slight interval between each of them. The openings of the scales of the lateral line situated near the upper and lower edges of the scales. (A state of things not, however, known in *P. speciosus*).

a. Number of rays in the anal fin 30—34, in the pectoral fins 11—13, number of vertebræ 78—85. The distance from the adipose fin to the end of the vertebral column amounts to 3—5 % of the total length exclusive of caudal fin.

P. Rissoi Bonaparte.

1. Number of rays in the anal fin 30—32, number of vertebræ 78—82. The length of the large teeth in the lower jaw amounts to about 4 % of the length of the snout.

P. rissoi rissoi Bonaparte.

2. Number of rays in the anal fin 31—34, number of vertebræ 83—85. The length of the large teeth in the lower jaw amounts to about 3 % of the length of the snout. *P. rissoi krøyeri* Lütken.

b. Number of rays in the anal fin 23—25, in the pectoral fins 14—16, number of vertebræ 67—74. The distance from the adipose fin to the end of the vertebral column amounts to 9—11 % of the total length exclusive of caudal fin.

1. Each of the premaxillaries has at most a single large tooth in front. The length of the large teeth in the lower jaw, which are missing in the adult specimens, amounts in the adolescent to less than 3 % of the length of the snout. *P. coregonoides* Risso.

α. Number of vertebræ 70 (of myomeres 70—74). *P. coregonoides coregonoides* Risso.

β. Number of vertebræ 72—74 (of myomeres 73—77). *P. coregonoides borealis* Reinhardt.

2. Each of the premaxillaries, at any rate in the adolescent specimens, has in front several fairly large teeth, of similar length to the large teeth in the lower jaw, the length of which amounting to 5 % of that of the snout. *P. speciosus* Bellotti.

B. The small teeth in the premaxillaries are, in the adult specimens, arranged in pairs with fairly large intervals alternating with quite small ones. The openings of the scales of the lateral line situated near the horizontal median line of the scales, placed at a comparatively slight distance from one another. *P. brevis* Zugmayer

II. The large teeth in the lower jaw are long, their length amounting to 7—11 % of the length of the snout. The preanal length amounts on an average to a little less than three fifths, in the examined specimens 54—61 %, of the total length exclusive of caudal fin.

A. Number of rays in the anal fin 27—32.

a. Ventral fins inserted in front of the dorsal fin at a distance from it equal to 6—9 % of the total length exclusive of caudal fin.

1. Length of dorsal fin at base amounting to about 4 % of the total length exclusive of caudal fin; number of its rays 11. Anus situated almost below the origin of the dorsal fin.

α. Number of vertebræ 88—92, number of rays in the pectoral fins 11. Length of head less than a fifth of the total length exclusive of caudal fin. *P. sphyrænoides* Risso.

β. Number of vertebræ 78—84, number of rays in the pectoral fins 12 (—13). Length of head greater than a fifth of the total length exclusive of caudal fin. *P. pseudosphyrænoides* Ege.

x. Number of vertebræ 81—84. *P. pseudosphyrænoides thori* Ege.

xx. Number of vertebræ 78—81. *P. pseudosphyrænoides danæ*, subsp. n.

2. Length of dorsal fin at base amounting to about 2.5 % of the total length exclusive of caudal fin; number of its rays 9—11. Anus situated in front of the dorsal fin, at a distance from it equal to about 4 % of the total length exclusive of caudal fin. *P. affinis*, sp. n.

b. Ventral fins inserted below the foremost part of the dorsal fin. *P. thermophilus*, sp. n.

B. Number of rays in the anal fin 42—44. *P. intermedius* Poey (?).

The form referred by Parr to *P. speciosus*, which, according to the description, differs so much from this that it must be regarded as a separate species, *P. brevirostris*, (Parr) sp. n., could not, on account of insufficient information, particularly regarding the dentition, be included in this synopsis. As regards its relation to *P. speciosus*, this must be referred to the special treatment of the individual species.

As stated, the synopsis is based on the investigation of adult and adolescent specimens. Several of the characters employed for the discrimination of these specimens, both those utilized in this synopsis and others, present themselves, however, in the same way in the older postlarvæ. This applies, first and foremost, to the numerical values which can be determined at this older postlarval stage, namely the number of vertebræ and the number of rays in the unpaired fins. This circumstance makes it possible to determine the specimens which are at the said stage. As such specimens are, besides, furnished with a pigment, specifically characteristic of most postlarval stages, they form a connecting link between the specimens at younger postlarval stages — which can be determined only by means of this pigment — and the adult.

In agreement with the main classification of the adult and adolescent specimens is this circumstance, that all the species entered under "I" reach the final preanal length and length of snout at about the same time, while the preanal length of those mentioned under "II" has reached its approximately final value at a younger postlarval stage, at which the length of the snout has increased but slightly compared with this length in the youngest postlarvæ. Besides, the further subdivision of the genus, in agreement with the above mentioned differences as to the pigmentation, is parallel with that dictated by the differences of character that apply to the older stages, as will be seen from the following synopsis.

I.

A. The number of the predorsal pigment sections of the peritoneum is four to six.
   a. The primary pigment of the tail, which is missing in the youngest stages, is limited to the hindmost part, consisting of two rows of comparatively small closely placed chromatophores. *P. Rissoi* Bonaparte.
   b. The primary pigment of the tail consists, at the youngest stages, of a single or a few dorsolaterally situated, large internal chromatophores, at the older, of a long dorsolateral row of detached similar chromatophores which stretches forward in front of the dorsal fin, together with a few ventrolaterally situated large chromatophores in the posterior part of the tail.
      1. Distance between the hindmost chromatophores about half the value of the least height of the tail. *P. coregonoides* Risso.
      2. Distance between the hindmost chromatophores about equal to the least height of the tail. *P. speciosus* Bellotti.

B. The number of the predorsal pigment sections of the peritoneum is two. *P. brevis* Zugmayer.

II.

A. The embryonic fin has no pigment.
   a. The primary pigment of the tail consists of several chromatophores, most of which situated near the ventral median line.
      1. Pigment consisting of three or four groups of chromatophores, of which the hindmost group situated near end of tail consisting of two or three rows.
         α. Pigment consisting of four groups of chromatophores. *P. sphyrænoides* Risso.
         β. Pigment consisting of three groups of chromatophores. *P. pseudosphyrænoides* Ege.
            x. The hindmost group consists of three rows, two lateral and one ventral. *P. pseudosphyrænoides thori* Ege.
            xx. The hindmost group consists of only two rows, the lateral. *P. pseudosphyrænoides dancæ*, subsp. n.
      2. Pigment consisting of only two groups or a pair of chromatophores, at the youngest stages of only two single chromatophores. Pigment near end of tail missing. *P. affinis*, sp. n.

b. The primary pigment of the tail consists of a single chromatophore situated near end of tail, at the youngest stages dorsally, at the older dorsolaterally.
P. thermophilus, sp. n.

B. The hindmost part of the embryonic fin has, both dorsally and ventrally, several large chromatophores. *P. intermedius* Poey (?).

The relation between the two forms of *P. Rissoi* and between those of *P. coregonoides* is not characterized by any difference as to the pigmentation. Concerning the discrimination of the forms of these two species, I would refer to the special treatment of the species.

The first knowledge of the postlarval development within the present genus is due to GÜNTHER, who (1889, p. 40, pl. V, fig. B) has given a description and drawing of a 14 mm. long *Paralepis*-specimen caught by the "Challenger", 1876, in the North Atlantic. The characteristic feature of the younger postlarvæ of the genus, the very advanced position of the anus, and the division of the pigment of the peritoneum into several sections which occurs in all postlarvæ, already finds expression here, in drawing and text. The defective preservation prevents the specific determination of the specimen. Later contributions to the same knowledge are referred to in the following.

B. THE INDIVIDUAL SPECIES.

1. PARALEPIS RISSOI Bonaparte.

a. PARALEPIS RISSOI RISSOI Bonaparte.

Paralepis coregonoides, Cuvier and Valenciennes, 1828—49, vol. III, p. 357.
Paralepis coregonoides, Bonaparte, 1832—41 (partim).
Paralepis coregonoides, Bellotti, 1877, p. 54 and 57.
Paralepis coregonoides, Vinciguerra, 1885, ser. 2, vol. II, p. 466.
Paralepis pseudocoregonoides, Sarato, 1887.
Paralepis Rissoi, Carus, 1889—93, p. 567.
Paralepis pseudocoregonoides, Moreau, 1891, p. 121.
Paralepis Risso, Bellotti, 1891, p. 138.
Paralepis Rissoi, Lütken, 1892, p. 226.
Paralepis Risso, Bellotti, 1892, p. 16.
Paralepis speciosus, Pietschmann, 1914, p. 440, Taf. VI, fig. 3.
Paralepis Rissoi, Sanzo, 1917.
Paralepis Rissoi, Ege, 1918, p. 243.
Sudis rissoi rissoi, Parr, 1928, p. 38.
Paralepis coregonoides (sensu lat.), f. *Paralepis Rissoi*, Roule and Angel, 1930, p. 65, pl. III, fig. 86 and 87.

The species was first described by CUVIER and VALENCIENNES (Hist. nat. des Poissons, vol. III, 1829, p. 357—59, pl. 67) on the basis of a specimen sent to them by RISSO under the name *Coregonus paralepis* (in RISSO's Hist. nat. etc. called *Paralepis coregonoides*). As the authors themselves point out later on, (op. cit., vol. VII., p. 510) the specimen described differs from RISSO's *P. coregonoides* in the number of rays in the anal fin, and, for that reason, it corresponds, if anything, to RISSO's *P. sphyrænoides*. Besides, as regards the description, there is an account of the dentition which likewise shows a characteristic difference from that in *P. coregonoides* (p. 358):— "Il n'y a à l'intermaxillaire que des dents si petites

qu'il faut une forte loupe pour les distinguer, elles sont nombreuses et serrées comme celles d'une scie. La mâchoire inférieure et les palatines en ont au contraire de grandes, grèles, crochues, très-pointues, qui dans leurs intervalles en ont d'autres plus petites."

In his Iconografia della Fauna Italica, BONAPARTE, describing a *Paralepis*-specimen referred to under "*Paralepis coregonoides*", states:— "..... sovra i margini predetti [dell' intermascellare] v'ha denti numerosi e fitti, ma così piccoli che appena son visibili con la lente qual simulacro di leggerissima sega; sulle ossa palatine poi ve n'ha di ben manifesti, grandetti, aculeati, volti all'indentro: nella mandibola sono pur denti anco più grandicelli, ugualmente tereti ed aculeati, verticali, radi, tra i quali nascono altri più piccoli quasi ricolchi, che volgono le punte verso la gola:....." He states nothing about the number of rays in the anal fin which, as he writes, if not variable is, however, very difficult to determine. When comparing the specimen with what CUVIER, in the third volume of his great work on fishes, has described and figured "per la *coregonoides* del Risso" he finds an exact similarity which, on the contrary, is not the case on a comparison with the specimen which the same author, in the seventh volume, changing his mind, declares to be "la *Coregonoides* vera", not without expressing a wish for the other to have exchanged the name with "*sphyrænoides*". On account of the position of the ventral fins, in relation to the dorsal fin, he cannot agree to call his specimen by the latter name, but suggests "*P. Risso*". With regard to proportions the author mentions that the length measures fourteen times the greatest height, and the head is a quarter of the rest of the fish. The figure in his work shows the position of the adipose fin near the caudal fin, above the hindmost rays of the anal fin; in which respect the species differs from *P. coregonoides* Risso; on the other hand, it does not admit of a determination of the number of rays in the anal fin, nor does it show the dentition.

According to SARATO (1887), there are two closely related species of *Paralepis*, differing from each other in the number of rays in the anal fin; he has allowed the first, with the lesser number, which is described in RISSO's Hist. nat. etc., to retain the specific name *Paralepis coregonoides*, the other he has called *P. pseudocoregonoides*. Regarding the dentition he writes *inter alia*:— "La mandibule de notre *Paralepis pseudocoregonoides* offre de chaque côté près du bord antérieur cinq à six dents serrées, un peu courbes, petites, ou médiocres, puis à 2 millimètres en arrière, une double série de dents fort inégales, les internes droites, alternativement courtes et allongées, les externes basses et recourbées, alternant avec les précédentes, les unes et les autres plus ou moins distinctes entre elles."

MOREAU (1891, p. 118 and 121—22) ascribes to this species a *Paralepis*-specimen, depicted in CUVIER's Règne Animal illustré (pl. 18, fig. 2), which VALENCIENNES designated with the name of *P. coregonoides*, and which BELLOTTI regards as representing *P. Cuvieri* Bp. (= *P. coregonoides* Risso). MOREAU's reason for this determination is, that the figure distinctly shows 30 rays in the anal fin, which is correct; the other important characters show, on the contrary, conditions which are characteristic of *P. coregonoides*, the reduced furniture of teeth, the comparatively great distance from the adipose fin to the caudal fin and the insertion of the ventral fins below the foremost part of the dorsal fin. It might almost be assumed that it was a specimen of the latter species which was the original of the figure, and that the large number of rays in the anal fin is taken from a specimen of *P. Rissoi*, at a period when the author did not make any distinction between the two species, an explanation one might venture to think more reasonable than BELLOTTI's, who is of opinion that the figure has got the great number of rays in the anal fin "per errore di incisione".

Measurements. The material, on which the present investigation is based, contains a large number of postlarvæ, but only a single older specimen, 196 mm. in length (St. 120, 1910, 300. m. w.). With a view to the possibility of a comparison with the measurements found by the previous authors, it is to be observed that the proportion between the length of the head and the total length (including the caudal fin) is 1 to 4.6, between the greatest height and the total length, 1 to 14.5.

In the following, various measurements of the specimen mentioned and of one of the large postlarval specimens are shown; the measurements are, besides, expressed in percentages of the total length exclusive of the caudal fin:—

	mm.		% of Tot. ex. C.	
	1.	2.	1.	2.
Total length	196	39		
Total length excl. caudal fin	188	37.4		
Predorsal length	125	24.4	66.5	65.2
Preventral length	130	25.1	69.1	67.1
Preanal length	135	25.8	71.8	69.0
Length to origin of anal fin	154	29.3	81.9	78.3
Length of head	43	9.6	22.9	25.7
Length of snout	22	5.1	11.7	13.6
Diameter of eye	6.5	1.7	3.5	4.5
Length of dorsal fin at base	6.7	1.1	3.6	2.9
Length of anal fin at base	28.3	6.4	15.1	17.1
Distance from anal fin to caudal fin	2.0	..	1.1	..
Distance from anal fin to end of vertebral column	6.2	1.7	3.3	4.5
Distance from adipose fin to caudal fin	2.2	..	1.2	..
Distance from adipose fin to end of vertebral column	6.4	abt. 1.8	3.4	abt. 4.8
Greatest height of body	13.5	3.4	7.2	9.1
Height at insertion of pectoral fins	13.5	3.4	7.2	9.1
Height at insertion of ventral fins	11.5	2.5	6.1	6.7
Height at foremost ray of anal fin	10.2	1.9	5.4	5.1
Height at hindmost ray of anal fin	4.3	1.2	2.3	3.2

In spite of the considerable difference in size, there is a fairly good agreement between the two individuals, except as regards the length of the head and the snout. In this species and, as will be shown later on, in closely related species, there is a peculiar circumstance, that the relative maximum length of the head is found in the large postlarval specimens, while a small length of head and snout is just the characteristic of the younger postlarval stages. As the difference between the preventral and the predorsal lengths shows, the ventral fins in both are inserted fairly far behind; in the large specimens below the eighth, in the postlarval below the fifth ray of the dorsal fin.

Dentition. The large specimen mentioned shows the following dentition. Each of the premaxillaries has two short teeth (0.2 mm.) in front; close up to them follow two fairly large teeth which are slightly curved and inclining backwards (the foremost 0.35, the hindmost 0.75 mm). After these follows a toothless interval. The hindmost two thirds of the premaxillary are occupied by a large number of tiny little teeth which, as BONAPARTE also expresses it, have the appearance of a very fine saw. In the front, on each side of the palate, there are seven large, slender teeth, inclining slightly backward (respectively 0.75, 0.85, 1.0, 1.0, 1.2, 0.75, and 1.0 mm.), with a smaller tooth at the base of some of these. After the large teeth follow thirteen small ones (0.1—0.25 mm.). In the lower jaw there is a long, slender curved tooth (1 mm.) on each side and, immediately in front of this, a tooth of the same type, but of only half the length; after a short interval follow five insignificant teeth (the longest 0.35 mm.), and then six long, round, slender, straight teeth (the foremost 0.8 mm., the two centre ones 1.1, the rest 1.0 mm.),

at the base of some of these there are one or two smaller teeth of the same shape (abt. 0.5 mm.); further back, there are a couple of short curved teeth with points inclining backwards.

In order that the lengths given, besides illustrating the proportion of the teeth to one another at the stage of development which the individual represents, should be able to serve as a means of comparison with corresponding ones in other individuals, and thus be able to show the proportion between various stages, and also be an expression for how the species, in that respect, compares with other species — the average length of the large teeth in the lower jaw is expressed in percentages of the length of the snout. This per cent value for the specimen afore mentioned is = 4.5.

In the postlarval specimen mentioned (Fig. 1) each premaxillary has a small tooth in front (0.1 mm.) and, close up to this, two large teeth (0.2 and 0.3 mm.); then follow nine short teeth (0.1 mm.), of which the five foremost are curved, with the points inclined backwards, and with intervals between them, while those that follow, with their long bases, give the hindmost part of the jaw a roughly jagged appearance. On each palatine there are three large teeth (abt. 0.15 mm.) in front, followed by seven small ones (abt. 0.05 mm.). In the lower jaw there are three closely set teeth in front, of which the innermost is the largest (0.25 mm.); they are less slender than the corresponding ones in the larger specimen, the diameter of their bases goes only $2^1/_2$ times into the length; after a short interval follow three small (0.05 mm.) and then five larger teeth (abt. 0.2 mm.), partly with small "companion teeth"; finally, furthest back in the jaw, there are three teeth (abt. 0.1 mm.) standing apart.

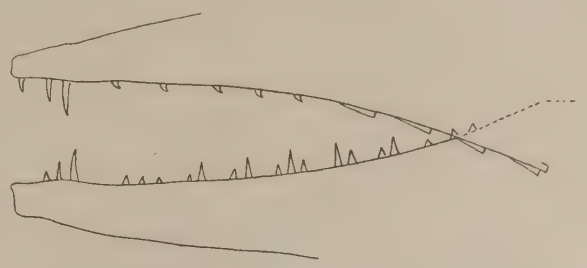


Fig. 1. *Paralepis rissoi rissoi* Bonaparte. Length ex. C. 37.4 mm. (St. 206, 1910). Premaxillary and mandibular dentition.

The average length of the large teeth in the lower jaw amounts to about 3.9 % of the length of the snout, which value is fairly well in agreement with that found in the larger specimen. The similarity between the two stages is, on the whole, most conspicuous in the case of the lower jaw. Whereas in the larger specimen the two posterior thirds of the premaxillary are occupied by a large number of tiny little teeth, there are, in the postlarval specimen, only nine relatively small teeth in the corresponding place. This difference can, however, with certainty be ascribed to the different grades of development, as in all known species of the genus quite a corresponding relation exists between the adult and postlarval specimens.

Numerical values. The material contains, unfortunately, only a couple of individuals sufficiently developed to be able to furnish the number of rays as regards all the fins; only where the anal fin is concerned, are there so many figures at hand that they can give a notion as to the range of variation. For comparison with the results given below, must be mentioned the formula regarding the rays of the fins stated by Cuvier and Valenciennes (op. cit., t. VII, p. 510):—

D. 10—6; A. 3/27; C. 17; P. 13; V. 1/8.

The material, on which the present investigation is based, has given the following figures:—

Station No.	Tot. ex. C. mm.	D.	A.	P.	V.	R. br.	Vert.
10	35	11	31	..	..	..	79
»	30	..	..	..	..	..	81
36	28	..	31	..	..	..	81
»	24	..	31	..	..	..	82
50	31	..	31	..	..	..	80

Station No.	Tot. ex. C. mm.	D.	A.	P.	V.	R. br.	Vert.
120	188	11	31	13	9	8	81
192	27	..	31	..	..	..	80
199	26	..	..	..	..	..	81
206	29	..	..	..	..	..	80
»	38	10	32	13	9	8	..
209	28	..	..	..	..	..	80
232	24	..	..	..	..	..	79
»	30	..	31	..	..	..	78
1107	21	..	30	..	..	..	..
»	25	..	32	..	..	..	78
»	26	..	..	..	..	..	79
1108	20	..	31	..	..	..	..
»	21	..	31	..	..	..	..
1123	24	..	32	..	..	..	82

In the large specimen there has, further, been found C. 13/19/13.

The number of rays found in the anal fin varies, thus, from 30 to 32, with the following division of the specimens:—

32 o o o
31 o o o o o o o o o o
30 o

The average value of the 13 figures is = 31.15. In the dorsal fin, I have found 10, 11 and 11 rays. As in all the species of the genus, the two hindmost rays in the dorsal and the anal fin are situated quite close together; these two rays are probably counted as one by Cuv. and Val. and by Bellotti who, likewise, has found 10 rays in the dorsal fin and 30 in the anal fin.

The number of vertebræ varies, according to the figures I have found, from 78 to 82, with the following division of the examined specimens:—

82 o o
81 o o o o
80 o o o o
79 o o o
78 o o

The average value of the 15 figures is = 80.07. The number of vertebræ can be determined in specimens larger than 24 mm.; in smaller specimens, in which the vertebræ are not sufficiently developed to be counted with certainty, I have counted the myomeres with the following result:—

Station No.	No. of myomeres
120	83
229	82, 82
206	81
1107	81, 81, 82, 82, 83
1108	80, 81, 82, 82, 83
1123	84
1128	83
1141	81, 82, 82

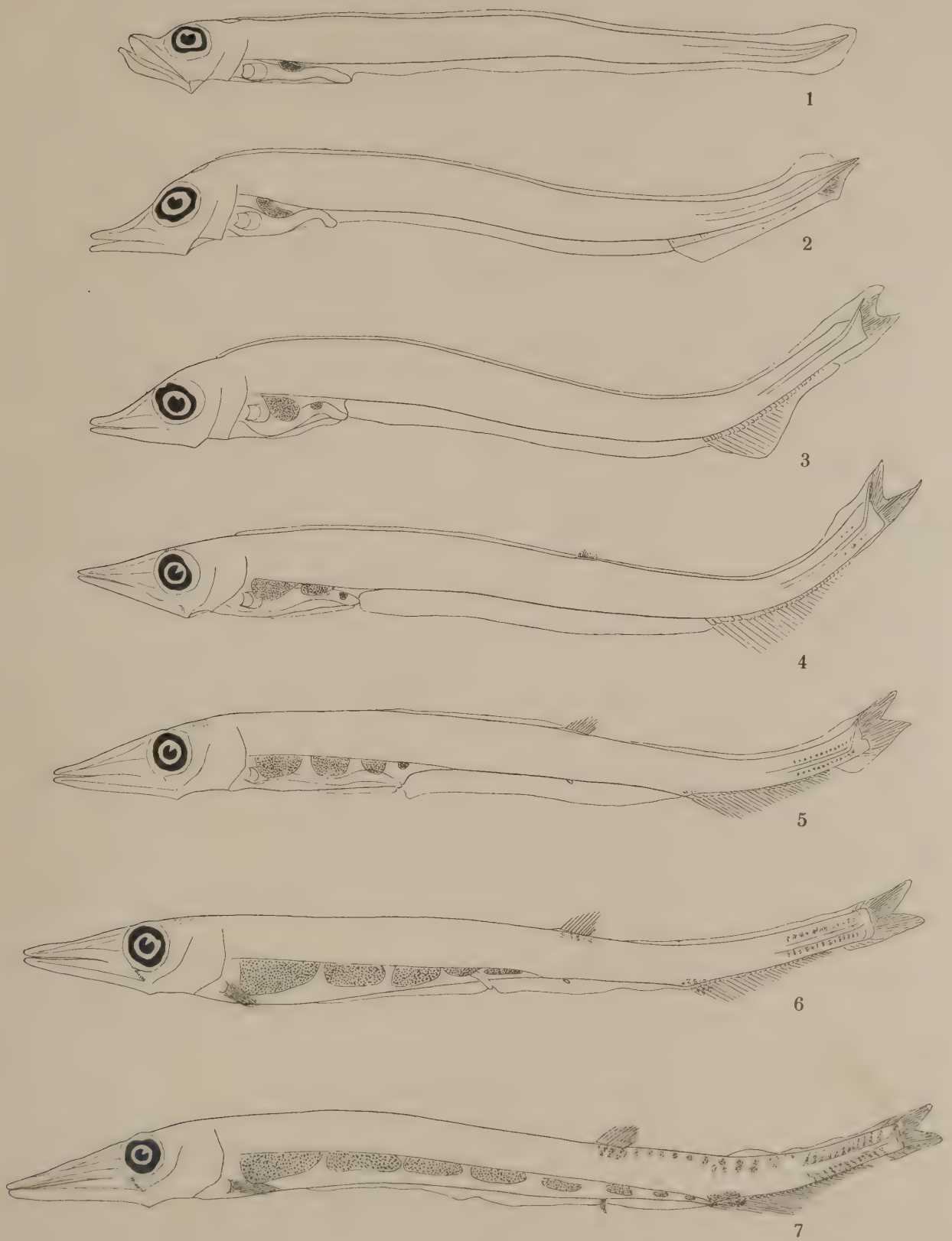


Fig. 2. *Paralepis rissoi rissoi* Bonaparte. Postlarval stages, length ex. C. 1 : 9 mm. (St. 143, 1910), 2 : 12.4 mm. (St. 143, 1910), 3 : 16.5 mm. (St. 143, 1910), 4 : 20 mm. (St. 143, 1910), 5 : 29 mm. (St. 50, 1909), 6: 33.5 mm. (St. 192, 1910) and 7 : 37.4 mm. (St. 206, 1910).

The figures give the following graph:—

84 o
83 o o o o
82 o o o o o o o o o
81 o o o o o
80 o

The average value of the 19 figures is = 81.95. As will be seen, the average value for myomeres lies approximately 2 above that for vertebræ, a difference which, most likely, is due to the foremost imperfect myomeres not having corresponding vertebræ. Besides showing the relation between the two categories, these results have the practical significance that, as it is warrantable to assume the presence of the same difference in other, at any rate closely related, species, one can, when advancing proofs for the specific identity of two different stages of a species, utilize the character of the number of vertebræ even in instances where, as regards the younger stage, this can be expressed only in the number of myomeres.

Postlarval development. Pietschmann (1914, p. 440, tab. VI, fig. 3) is the first who has figured and described a postlarval specimen of the species, to be sure under an erroneous specific name. The largest of the three specimens, 35 mm. in length, which the said author (l. c.), under the name of *Paralepis speciosus* Bellotti, has described in some detail, as regards the pigmentation, must, in accordance with the description as well as the drawing, both of which *inter alia* show the presence of the pigment characteristic of *Paralepis Rissoi*, be determined as this species.

Besides, Sanzo (1917, p. 1—9) has described the postlarval development in this form and, in some detail, gone through five stages of 9.8, 15.9, 23.2, 32.7 and 46.4 mm.s length respectively. The descriptions of these stages agree well with my observations. Roule and Angel (1930, p. 65—66, pl. III, fig. 86 and 87) have described and figured a fairly old postlarval specimen (total length excl. caudal fin = 44 mm.). The length of the head which is stated to go $3^3/_5$ times into the total length — in a specimen of the same length of the other form of the species, *P. rissoi krøyeri*, in our material this proportion is $4^1/_5$ — as well as the number of the predorsal pigment sections of the peritoneum show that the specimen mentioned by these authors is to be referred to the southern form. As Sanzo's descriptions are not accompanied by illustrations, I consider it reasonable, particularly with regard to a comparison with *P. rissoi krøyeri* Lütken, to publish a series of drawings of the southern form as well (Fig. 2). As it will appear from a comparison of the two series, the different stages show a close connection with the corresponding stages of *P. rissoi krøyeri*. I shall, however, confine myself to give the total lengths excl. caudal fin of the specimens figured, together with the preanal lengths and lengths of snout, expressed in percentages of these:—

Total length excl. caudal (mm.)	9.0	12.4	16.5	20.0	29.0	33.5	37.4
Preanal length in % of total length	31.3	31.5	31.8	34.1	42.7	54.9	69.0
Length of snout in % of total length	5.0	7.7	8.5	9.6	12.3	12.5	13.6

b. PARALEPIS RISSOI KRØYERI Lütken.

Paralepis borealis, Krøyer, 1847, p. 241.
Paralepis borealis, Krøyer, 1842—56, pl. 16 B, fig. 1.
Paralepis borealis, Günther, 1864, p. 418.
Arctozenus borealis, Gill, 1864, p. 188.
Sudis borealis, Jordan and Gilbert, 1883, p. 278.

Sudis borealis, Jordan, 1887, p. 826.
Paralepis Krøyeri, Lütken, 1892, p. 222.
Paralepis borealis, Goode and Bean, 1896, p. 119, pl. 38, fig. 143.
Arctozenus borealis, Jordan and Evermann, 1896, p. 601.
? *Paralepis pseudocoregonoides*, Collett, 1896, p. 117. ?
Sudis Krøyeri, Collett, 1897, p. 21.
Sudis Krøyeri, Collett, 1903, part. 2, p. 117.
Paralepis Krøyeri, Jensen, 1904, p. 272.
Paralepis Krøyeri, Sæmundsson, 1908, p. 100.
Paralepis krøyeri, Grieg, 1911, p. 28.
Paralepis Krøyeri, Ege, 1918, p. 243.
Paralepis Krøyeri, Nordgård, 1924, p. 4.
Paralepis Krøyeri, Knipovich, 1926, p. 76, fig. 35.
Paralepis Krøyeri, Sæmundsson, 1926, p. 395 og 1927 a, p. 44.
Sudis rissoi krøyeri, Parr, 1928, p. 39.

In connection with the above synonymy, the following is to be remarked. Lütken, in describing the species (1892, p. 227—31), has thoroughly cleared up its relation to *Paralepis borealis* Reinhardt, and pointed out that the one, very exhaustively described and figured under this name by Krøyer, is different to Reinhardt's species and specifically identical with *Paralepis Krøyeri*. Günther has committed the same mistake as Krøyer in giving *Paralepis borealis* Rhdt. the number of rays in the anal fin and the pectoral fins typical of Lütken's species. I have had an opportunity of examining the form referred to under the name of *Arctozenus* (*Sudis, Paralepis*) *borealis* by American authors (Gill, Jordan and Gilbert, Jordan and Evermann, Goode and Bean) which, as for instance Grieg (1911 p. 30—31) mentions, might likewise be considered identical with *Paralepis Krøyeri* for *inter alia* the radial formulæ and position of the ventral fins, in relation to the dorsal fin, were in agreement with Lütken's diagnosis; the result of the examination is that I can fully confirm the correctness of this opinion.

Collett (1896, p. 117), with some doubt, refers two specimens from the Bay of Biscay (47° 26′ N. lat., 9° 17′ W. long.) to *Paralepis pseudocoregonoides* Sarato. He mentions *inter alia*:— "Les caractères distinctifs sont les dents de la mandibule, qui sont fortes et de différente longueur, ainsi que les ventrales qui sont placées très loin en arrière." The length of the head to the total length is as 1 to 4.75; the height of the body can be given only approximately, but seems to go about 12 times into the total length. Unfortunately no statement as to the number of fin rays is given (the two specimens were more or less damaged) which might have led to a decision being made. The characters stated are common to *P. rissoi rissoi* and *P. rissoi krøyeri*, and only the locality makes it probable that Collett's specimen is to be referred to the northern form.

Knipovich mentions (1926, p. 182) that *Paralepis Krøyeri* has repeatedly been observed in Kola Fiord. The stated ray figures for the fins and the annexed drawing seem to show that his determination is correct.

Parr's designation of the form, which expresses the close relationship between it and Bonaparte's *Paralepis*, is based exclusively on literary study, and thus signifies no progress beyond the remarks made by Lütken in regard to the relation between the forms.

Measurements. Lütken, comparing Reinhardt's species with his own, mentions the following proportions in *P. Krøyeri*:— 1) the proportion between the length of the head and the total length exclusive of caudal fin is 1 to 4.4—4.9; 2) the ventral fins are perceptibly behind the dorsal fin — behind, or at most, below its last ray; 3) the distance from the adipose fin to the short foremost rays of the caudal fin is very slight (only 5—6 mm., the total lengths being 287 and 230 mm.).

I have been able to examine one of LÜTKEN's specimens, and, with regard to the stated measurements, I have come to the same result; the proportion between the length of the head and the total length excl. caudal fin is 1 to 4.91, and the ventral fins are inserted immediately behind the dorsal fin. The American specimens examined show a very satisfactory agreement with the foregoing; the proportion between the length of the head and the total length excl. caudal fin is 1 to 4.64—4.79, the ventral fins are inserted behind the dorsal fin at an insignificant distance from it, and the adipose fin is close to the caudal fin.

For a comparison of the adult specimens with the large portion of the material which forms the basis of this investigation, the postlarval specimens, there have, of the latter, been utilized only the larger ones which, at the outset, must be assumed to differ least from the adults. The proportion between the length of the head and the total length is, in specimens which measure 46—62 mm., the following:— 1 to 4.28, 1 to 3.94, 1 to 4,26, and 1 to 4.21. In all four individuals, the insertion of the ventral fins in relation to the dorsal fin, is the same, namely, situated immediately behind the last ray in the dorsal fin. Only in the largest individual is the adipose fin sharply limited, the distance from it to the short front rays of the caudal fin is = 0.7 mm.

In the lists below the measurements mentioned are arranged, supplemented with several others in LÜTKEN's specimens, the American specimens and postlarvæ, both from the eastern and western distribution areas (the last ones from St. 1024). The first gives the directly observed measurements, the second, the same measurements expressed in percentages of the total length excl. caudal fin.

The running numbers refer to the following informations:—

No. 1. — Københavns Universitets Zoologiske Museum. — *P. Krøyeri* Lütken No. 4, South-Greenland, Dr. Rink 1861.
No. 2. — U.S. Nat. Mus. — "Albatross", St. 2676 (32° 39' N. lat. — 77° 01' W. long), May 1886, 407 fms.
No. 3. — U.S. Nat. Mus. — "Albatross", St. 2677 (32° 39' N. lat. — 76° 50' W. long), May 1886.
No. 4. — U.S. Nat. Mus. — J. F. Whiteaves, Acad. N. Sc. Montreal—N. Atlantic.
No. 5. — "Thor", St. 74, 1906, 2000 m. w.
No. 6. — "Thor", St. 93, 1905, 300 m. w.
No. 7. — "Thor", St. 80, 1906, 1200 m. w.
No. 8. — "Margrethe", St. 1024, 1913, 300 m. w.

	mm.							
	1.	2.	3.	4.	5.	6.	7.	8.
Total length	abt. 300	269	268	..	66	50	48	48
Total length excl. caudal fin	285	260	261	243	62	46.5	45	46
Predorsal length	188	168	169	160	40.7	30.1	28.8	29.2
Preventral length	197	..	179	168	42.6	31.2	30.2	30.6
Preanal length	205	..	187	175	..	31.0	30.1	30.5
Length to origin of anal fin	236	211	211	199	50.0	36.3	35.5	36.0
Length of head	58	56	54.5	51	14.5	11.8	10.7	10.8
Length of snout	30	29.5	28.5	26	7.8	6.2	5.5	5.6
Diameter of eye	9	10	9	8	2.1	2.0	1.8	1.8
Length of dorsal fin at base	9	9	8.5	7.5	1.8	1.2	1.2	1.3
Length of anal fin at base	42	40	41	..	10.2	7.8	7.5	8.1
Distance from anal fin to caudal fin	2	3	4.5	..	0.7	..	..	..
Distance from anal fin to end of vertebral column	7	7	9	..	2.6	2.0	1.9	1.9
Distance from adipose fin to caudal fin	6	4.5	4.5	..	0.7	..	..	..
Distance from adipose fin to end of vertebral column	10.5	9	9	..	2.9	..	..	..
Greatest height of body	30	..	..	..	..	3.3	3.2	3.3
Height at insertion of pectoral fins	24	..	..	..	..	3.3	3.2	3.3

	1.	2.	3.	4.	5.	6.	7.	8.
Height at insertion of ventral fins	25	..	..	..	..	2.2	2.4	2.4
Height at foremost ray of anal fin	19	..	..	..	..	1.9	2.2	2.2
Height at hindmost ray of anal fin	6	..	..	..	..	1.2	1.3	1.3

	% of Tot. ex. C.							
	1.	2.	3.	4.	5.	6.	7.	8.
Predorsal length	66.0	64.6	64.8	65.8	65.6	64.7	64.0	63.5
Preventral length	69.1	..	68.6	69.1	68.7	67.1	67.1	66.5
Preanal length	71.9	..	71.6	72.0	..	66.7	66.9	66.3
Length to origin of anal fin	82.8	81.2	80.8	81.9	80.6	78.1	78.9	78.3
Length of head	20.4	21.5	20.9	21.0	23.4	25.4	23.8	23.5
Length of snout	10.5	11.3	10.9	10.7	12.6	13.3	12.2	12.2
Diameter of eye	3.2	3.8	3.4	3.3	3.4	4.3	4.0	3.9
Length of dorsal fin at base	3.2	3.5	3.3	3.1	2.9	2.6	2.7	2.8
Length of anal fin at base	14.7	15.4	15.7	..	16.5	16.8	16.7	17.6
Distance from anal fin to caudal fin	0.7	1.2	1.7	..	1.1	..	..	..
Distance from anal fin to end of vertebral column	2.5	2.7	3.4	..	4.2	..	..	..
Distance from adipose fin to caudal fin	2.1	1.7	1.7	..	1.1	..	..	..
Distance from adipose fin to end of vertebral column	3.7	3.5	3.4	..	4.7	..	..	..
Greatest height of body	10.5	..	..	..	..	7.1	7.1	7.2
Height at insertion of pectoral fins	8.4	..	..	..	..	7.1	7.1	7.2
Height at insertion of ventral fins	8.8	..	..	..	..	4.7	5.3	5.2
Height at foremost ray of anal fin	6.7	..	..	..	..	4.1	4.9	4.8
Height at hindmost ray of anal fin	2.1	..	..	..	..	2.6	2.9	2.8

The defective preservation of the American specimens has been the cause of several of the rubrics remaining empty, but, as it will be seen, no difference can be pointed out, as regards the remaining measurements, between these specimens and LÜTKEN's specimen. On the contrary, the agreement between the adult specimens and the postlarvæ is not, in every respect, immediately evident. Thus the length of the head (as also shown by previously mentioned proportional figures) is larger in the latter. A comparison between the three postlarval specimens from the East Atlantic and the one coming from the western portion of the expansion range of the species, shows that, as regards the examined proportions, no difference can be pointed out between the representatives from the two areas mentioned above.

Dentition. To LÜTKEN's description of the dentition in the adult specimens, I shall — in view of a comparison with the dentition in a young individual — merely add some measurements from the one of LÜTKEN's specimens I have had the opportunity to examine. On each of the palatines there are six large teeth (the largest 1.5 mm.), accompanied by smaller ones together with eleven small teeth (0.1—0.2 mm.). The lower jaw has, on each side, a single large tooth (0.8 mm.) in front, after a short interval follow (along with smaller accompanying teeth) ten slender teeth of which the two foremost are 0.5 mm., the third 0.7 and the rest abt. 1 mm. (the longest is 1.3 mm.). The average length of the large teeth in the lower jaw amounts to 3.3 % of the length of the snout.

The dentition in an older postlarval specimen, 62 mm. in length, from St. 74, 1906, 2000 m. w. (Fig. 3) is as follows. Each premaxillary has in front three larger, slender teeth (the two innermost 0.3 mm.), after a short interval follow fifteen small teeth which occupy the greater portion of the premaxillary, the three foremost are isolated from one another and have a slender curved form (0.08 mm.), while the rest (0.05 mm.), with their long bases, crowd together and give the inner half of the jaw a

saw-like appearance. The palatines have three large teeth (0.2—0.3 mm.) followed by about fifteen curved ones, with points inclining backwards, their size decreases gradually from front to back (the largest 0.05 mm.). The lower jaw has, in front, three large slightly curved teeth of which the innermost is longest (0.35 mm.); after an interval, occupied by six small teeth (0.05—0.1 mm.), follow eight larger straight ones (0.2—0.3 mm.), partly accompanied by one or two small teeth placed at the base of the larger; furthest in, there are again some small teeth (0.1 mm.). The average length of the large teeth in the lower jaw amounts to 3.2 % of the length of the snout, which is = 7.8 mm.

If this dentition is compared with that in the adult specimens of *P. Krøyeri*, as described by LÜTKEN, an agreement will be found only in the main features. In the premaxillaries, LÜTKEN also finds, in front, a group of larger teeth, on the contrary, however, a very compact row of numerous small teeth, where the young specimen described above has only fifteen comparatively large ones. This difference is due to the different degree of development; in *P. rissoi rissoi* an exactly corresponding relation existed between postlarval and adult specimens. In the lower jaw the relation of the teeth to one another is the same as in the adult specimens, but the larger teeth are not particularly slender in the young individual. On the palatines LÜTKEN finds six to ten larger teeth, in the young specimen there are only three. The lengths of the larger teeth in the lower jaw may be said to agree in the two specimens as, on an average, this length amounts to 3.3 % of the length of the snout, in the adult specimen, and 3.2 %, in the postlarval.

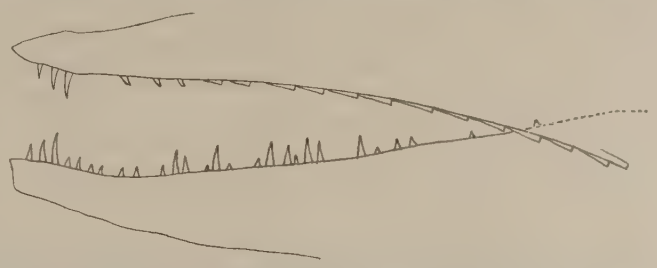


Fig. 3. *Paralepis rissoi krøyeri* Lütken. Length ex. C. 62 mm. (St. 74, 1906). Premaxillary and mandibular dentition.

Numerical values. For the investigation of the numeral values, the material is utilized in the widest possible extent. Unfortunately, only the minority of the postlarval specimens are sufficiently developed to admit of these values being determined with certainty. As the list below shows, this circumstance is particularly the case as regards the dorsal, pectoral and ventral fins, while, on the contrary, the anal fin and vertebral column are so far advanced in development that they can be utilized, for this object, in individuals that have reached the length of 30 mm.

Station No.	Tot. ex. C. mm.	D.	A.	P.	V.	R.br.	Vert.
93, 1905	47	10	33	12	9	8	83
» »	41	10	32	11	..	8	84
36, 1906	30	..	31	..	..	..	..
51, »	27	..	32	..	..	..	..
54, »	30	..	31	..	..	..	..
55, »	28	..	32	..	..	..	..
61, »	32	10	34	..	..	..	85
62, »	33	..	32	..	..	..	84
» »	30	..	..	..	..	..	84
66, »	29	..	33	..	..	..	84
» »	28	..	..	..	..	..	84
» »	28	..	32	..	..	..	85
» »	28	..	..	..	..	..	85
74, »	38	..	..	..	..	..	83

Station No.	Tot.ex.C. mm.	D.	A.	P.	V.	R.br.	Vert.
74, 1906	63	10	33	12	9	8	84
76, »	30	..	32	..	..	..	..
80, »	46	11	33	12	9	8	..
» »	35	..	..	..	..	..	84
167, »	38	10	32	..	..	8	..
» »	30	..	..	..	..	..	83
74, 1909	35	10	31	..	..	8	83
1024	45	10	31	12	9	8	84
»	39	..	33	..	..	..	85
»	37	..	32	..	..	8	84
»	32	..	32	..	..	..	83
»	30	10	32	..	..	..	83
»	29	..	33	..	..	..	83
»	27	..	..	..	..	..	84
1103	28	..	..	..	..	8	83

Now, first as regards the anal fin, KRØYER (1847, p. 242) specifies 32 rays, LÜTKEN has found a ray figure from 28 to 32 (probably he has reckoned the two hindmost rays, closely placed to each other, as a single one), JENSEN (1904, p. 272—73) found 31 rays in a specimen from Sermiligak Fiord, GRIEG (1911, p. 29) found 32 rays in a specimen from Smølen, western coast of Norway. JORDAN and GILBERT (1882, p. 278) and GOODE and BEAN (1895, p. 119) specify 32 rays. I have, in LÜTKEN's specimen, found 32, in the American 32, 33 and 33 rays, in specimens from the south-eastern coast of Iceland, procured in 1930 by Dr. B. SÆMUNDSSON, 32 rays in six and 33 in seven individuals. In the investigated postlarval specimens, the ray figure of the anal fin varies from 31 to 34; the division of the specimens on the variates is as follows:—

	Eastern area	St. 1024
34	o	
33	o o o o	o o
32	o o o o o o o o	o o o
31	o o o	o

The average values are, expressed with one decimal, alike for the two samples, *viz.* = 32.2; for the material added together it is = 32.19.

The number of rays in the dorsal fin is specified by all authors to be 10. I have in LÜTKEN's specimen found 10, in the American 10 and 11 rays, in the above mentioned specimens from Iceland 10 rays in twelve and 11 in four individuals. Of the nine postlarval specimens in which the rays were to be counted, eight had 10, and one 11 rays.

As regards the pectoral fins, KRØYER cites 11 rays, LÜTKEN "at most 10 to 11", JENSEN 12, GRIEG 11 rays. In LÜTKEN's specimen, I have found 12, in the American 11, 12 and 12 rays, in the specimens from Iceland 11 rays in one, 12 in twentythree and 13 in three individuals. The few investigated postlarval specimens seem, likewise, to show that 12 is the most frequently occurring number.

The number of vertebræ has already been investigated by KRØYER (1847, p. 251) who found 83 vertebræ. In LÜTKEN's specimen I have found 84, in the American 83 and 84 vertebræ, in the specimens from Iceland 83 vertebræ in two, 84 in eight and 85 in five individuals. In the investigated postlarval specimens the number varies from 83 to 85 with the following division of the specimens:—

	Eastern area	St. 1024
85	o o o	o
84	o o o o o o o o	o o o
83	o o o o	o o o o

The average values are, for the fourteen specimens, = 83.93, for the eight from St. 1024, = 83.62, for the aggregate material, = 83.82. Though the material is, thus, too small to prove the existence of an identity between the two lots, it shows, however, that, in any case, there is a question of only a very trifling difference.

Postlarval development. The great proportional increase which, during the postlarval development, takes place in the preanal length and the length of snout, should be considered in its entirety and treated by itself, apart from the description of the individual stages. The specimens included in the following synopsis are, however, the same as those on which the drawings and the descriptions attached to these are based:—

Total length excl. caudal (mm.)	9.5	13	18	20.5	23	28	30	38	45
Preanal length in % of total length	33.7	32.7	32.5	32.7	35.1	36.6	40.1	63.0	66.9
Length of snout in % of total length	3.9	5.6	8.7	9.6	10.2	11.2	10.5	11.3	12.2

As will be seen, the preanal length is about the same at the younger stages until a length of abt. 20 mm., is reached, *viz.* a third of the total length, while in specimens of double the length it has reached its final value, two thirds of the total length. As regards the length of the snout, the essential increase takes place before the aforementioned limit of size is reached.

Fig. 4, 1 shows a specimen *9,5 mm.* in length. The body, with the exception of the portion furthest to the front, is surrounded by a continuous embryonic fin. The tail is pointed, the end of the notochord quite straight, there is no indication of hypurals. The upper jaw is bent upwards, the length of the snout is less than the greatest diameter of the eye, the eye is oblong. The pectoral fins are indicated, the others lacking, on the upper side of the intestine there is, in front, a pigmented, elongated area, the beginning of the foremost pigment section of the peritoneum; otherwise no pigment.

13 mm. (Fig. 4, 2) The end of the tail is the same as in the preceding stage. The length of the snout is about equal to the greatest diameter of the eye. Besides the indication of the pectoral fins there is a beginning of the anal fin, the foremost interspinous rays of which are suggested. The pigmented area above the intestine is considerably larger than in the preceding stage.

18 mm. (Fig. 4, 3). The tail is only slightly pointed, the end of the notochord bent slightly upwards, the hypurals indicated. The rays of the caudal fin suggested; in the anal fin most of the interspinous rays are indicated and the rays in the foremost part of the fin distinguishable.

20.5 mm. (Fig. 4, 4) The end of the notochord is strongly bent upwards, the posterior margin of the hypurals almost vertical. The rays in the caudal fin can be counted and are articulated, in the anal fin the interspinous rays are distinguishable, with the exception of the hindmost two or three, as are also most of the rays, but none of these are yet formed. The dorsal fin is faintly suggested, at present merely as a thickening in the embryonic fin without any differentiation. Between the intestine and the myomeral body are two peritoneal pigment sections, the larger, foremost, is less elongated than in the specimen mentioned above. On the side of the tail, above the hindmost part of the anal fin, are some stellate chromatophores, two above and three below the notochord.

23 mm. (Fig. 4, 5). The extreme end of the notochord is reduced, the posterior margin of the hypurals vertical. The anal fin is not yet so far developed that one can with certainty count the rays, the rays not articulated. The dorsal fin is quite low, only its foremost rays suggested. There are three peritoneal pigment sections, the last indicated hindmost is but slightly developed. The dorso- and ventrolateral rows of stellate chromatophores which, in the above mentioned specimen, are above the hindmost part

of the anal fin, are, in this, prolonged backwards, and consist of six chromatophores each, besides, there are four stellate chromatophores at the base of the foremost rays in the anal fin. Pigment has now developed on the head, a few larger chromatophores interorbitally, and many small ones on the lower jaw and the point of the snout.

28 mm. (Fig. 4, 6). In the caudal fin, some of the small dorsal and ventral rays are indicated, the anal is so far developed that the number of rays can be determined, the dorsal fin has now raised itself above the embryonic fin, and most of the rays are distinguishable. The first indication of the ventral fins is seen, at present situated below the dorsal fin. There are five peritoneal pigment sections, the size of which, as in the preceding stages, decreases from front to back, the last situated above the extreme tip of the gut. The dorso- and ventrolateral rows of chromatophores, on the hindmost part of the tail, reach to a point where the notochord bends upward and consist of twelve in each row; they are elongated and go outwards from the notochord in the same direction as the myomeres. Above the foremost part of these two rows there is a dorsal row consisting of four chromatophores, and below the middlemost part of these two rows a ventral row of three chromatophores. The pigment at the base of the foremost rays of the anal fin has increased and stretches out on the rays. The pigment on the head is the same as in the specimen described above.

30 mm. (Fig. 4, 7). It is not until this stage that any perceptible increase of the preanal length has taken place. The dorsal part of the embryonic fin is interrupted by the dorsal fin, and is seen to begin again nearly above the foremost rays of the anal fin; the number of rays in the dorsal fin can be determined; the ventral fins are still inserted below the dorsal fin, no rays being yet visible. There are five peritoneal pigment sections, the hindmost, which is the smallest, lies behind the anus. The pigment on the tail is approximately the same as in the preceding stage; the two long rows of chromatophores are now less distinct, covered as they are with thicker layers of tissue. The dorsal pigment on the head stretches further backward than in the specimen described above.

38 mm. (Fig. 4, 8). The wall of the abdominal cavity is so far formed as to hide the contours of the intestine. The anus lies a little in front of the origin of the dorsal fin. The ventral fins have moved backwards, and the rays are indicated; the pectoral fins, which in all the stages described above have been at about the same stage of development, have now assumed a shape which approaches the appearance of this fin in the adult fish; and most of the rays have appeared. The embryonic fin is quite low dorsally, with the exception of the hindmost portion, in which the adipose is to be formed. The row of the peritoneal pigment sections reaches to the ventral fins and consists of six larger and two tiny ones, the three hindmost of the larger ones are still quite narrow. The pigment rows on the side of the tail are less distinct than in the specimens described above, and, in front of the four dorsal chromatophores, the beginning of the development of a secondary pigment is to be seen. The pigment on the head is augmented with a row of diminutive chromatophores along the posterior margin of the orbit and the anterior margin of the præoperculum. On the lower jaw there is now a pigment also along the upper edge.

45 mm. (Fig. 4, 9). The anus lies immediately in front of the insertion of the ventral fins. The dorsal fin is considerably longer and higher than at the preceding stage; most of the small rays of the caudal fin are present; the adipose fin indicated but not yet distinctly formed; the embryonic fin greatly reduced on the dorsal side. The pectoral and ventral fins are so far developed that their rays can be counted. The peritoneal pigment sections reach almost to the anal fin, and the row consists of six larger and six smaller ones, the five hindmost lie behind the ventral fins, at little intervals from each other; the origin of the dorsal fin lies above the hindmost part of the sixth section. The dorso- and ventrolateral rows of chromatophores on the sides of the tail are about to disappear, and the chromatophores at the base of the dorsal fin have become indistinct. The secondary dorsal pigment, between the dorsal and anal fins, has spread out. The pigmentation of the head is about the same as in the preceding, only, that a row of small chromatophores has developed on the præoperculum.

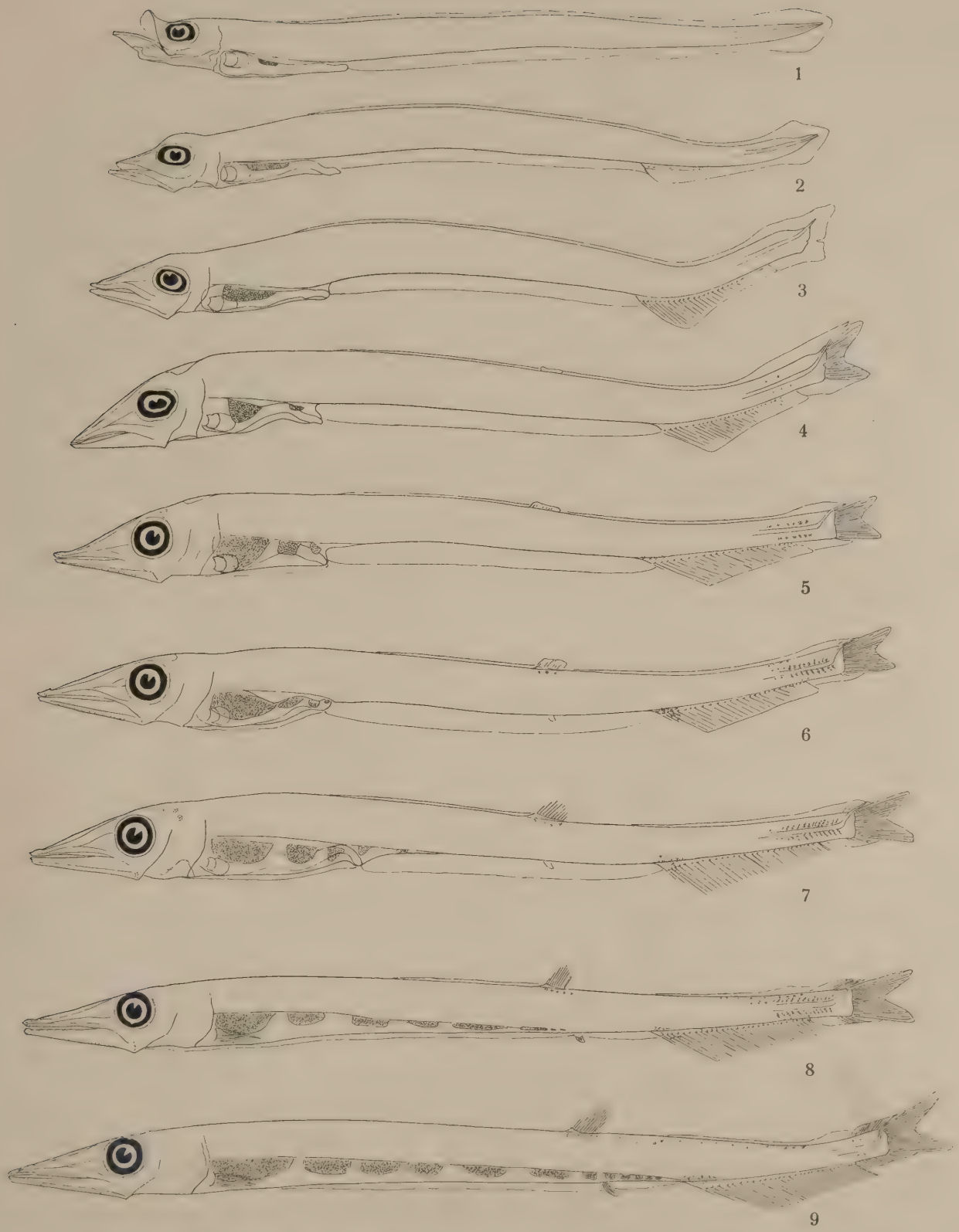


Fig. 4. *Paralepis rissoi krøyeri* Lütken. Postlarval stages, length ex. C. 1: 9.5 mm. (St. 51, 1906), 2: 13 mm. (St. 52, 1906), 3: 18 mm. (St. 52, 1906), 4: 20.5 mm. (St. 52, 1906), 5: 23 mm. (St. 52, 1906), 6: 28 mm. (St. 168, 1906), 7: 30 mm. (St. 36, 1906), 8: 38 mm. (St. 167, 1906) and 9: 45 mm. (St. 80, 1906).

c. COMPARISON BETWEEN PARALEPIS RISSOI RISSOI BONAPARTE AND PARALEPIS RISSOI KRØYERI LÜTKEN.

LÜTKEN writes (l. c., p. 231) in connection with his diagnosis of the two northern species: "According to this, *P. borealis* seems to come nearest to *P. coregonoides* (*Cuvieri* Bonap.) of the Mediterranean species, *P. Krøyeri* to *P. Rissoi*, without there at present — as the matter now stands — being any reason to assume that they should be identical with these forms. Better and more abundant material must be available before one, with real benefit, can take up this question for final discussion."[1]) As the preceding will have shown this investigation has confirmed LÜTKEN's opinion, that his and BONAPARTE's *Paralepis*-forms are closely related, but yet well distinguished. Common to them both are certain proportions, the close proximity of the adipose fin to the caudal fin, the predorsal length which amounts to about two thirds, while that in most of the other species amounts to about three fifths of the total length exclusive of caudal fin, the position of the ventral fins behind, or below, the hindmost rays of the dorsal fin (in *P. rissoi rissoi* below the 7th—8th ray). The head (and snout) seem, to judge by the examined specimens, to be a little longer in *P. rissoi rissoi*, but there is an insufficiency of material of adult specimens to elucidate this relation more clearly. As previously mentioned, the dentition presents no essential differences; here, it is only necessary to put in mind, that the average lengths of the large teeth in the lower jaw, in the two examined specimens of *P. rissoi rissoi*, amount to 4.5 and 3.9 %, in those of *P. rissoi krøyeri* to 3.3 and 3.2 % of the length of the snout, a difference which can hardly be ascribed to chance. The numerical values, I think, give the best expression for the relation between the two forms. It has been possible to examine the number of vertebræ and the number of rays in the anal fin of so many individuals that the difference found cannot deviate much from the reality. The collected results are as follows:—

	P. rissoi krøyeri	*P. rissoi rissoi*
Vert.		
85	o o o o o o o o o	
84	o o o o o o o o o o o o o o o o o o o o	
83	o o o o o o o o o o o	
82		o o
81		o o o o
80		o o o o
79		o o o
78		o o
	$a_{40} = 83.95$	$a_{15} = 80.07.$
A.		
34	o	
33	o o o o o o o o o o o o o o o o	
32	o o o o o o o o o o o o o o o o o o	o o o
31	o o o o	o o o o o o o o o
30		o
	$a_{38} = 32.34$	$a_{13} = 31.15$

As regards the other fins, there are but a few figures available in the case of the southern form. The most generally occurring number of rays in the dorsal fin is, in *P. rissoi krøyeri* 10, in *P. rissoi rissoi* 11, in the pectoral fins in *P. rissoi krøyeri* 12, in *P. rissoi rissoi* 13.

[1] Translated from Danish.

Through the calling of attention to these different relations, the maintenance of the two forms as separate subspecies of BONAPARTE's species may safely be said to be warranted.

As will be seen by a comparison of the drawings of the postlarval stages of the two forms, the pigmentation at most of the stages is about the same. Only in the older stages does a difference assert itself, with regard to the number of the peritoneal pigment sections, which are somewhat larger in *P. rissoi krøyeri*. As the hindmost small sections are often more or less merged together, it will be expedient to compare the numbers of the predorsal sections, in preference to the total numbers. In *P. rissoi krøyeri*, the sixth section lies in front, or, at any rate, with only a small portion protruding below the dorsal fin, while *P. rissoi rissoi* has only five predorsal sections.

As regards the younger stages, at which the specimens are not sufficiently developed that their numerical value can be determined — nor can the myomeres be counted with certainty in specimens less than about 20 mm. — it is, then, only possible to distinguish the two forms from each other by means of differences of dimension. The best character, in this respect, is the length of the snout. The following synopsis shows the results of the measurement of this length, expressed in a percentage of the total length excl. caudal fin. The material is derived respectively from stations situated S. W. of Ireland and in the Bay of Biscay — and from others in the Mediterranean and the Bay of Cadiz, for the greater part the same stations from which larger specimens of this form are at hand, these determined by means of the numerical values.

Total length excl. caudal	Length of snout in % of total length	
mm.	*P. rissoi krøyeri*	*P. rissoi rissoi*
29.0—30.9	10.1—11.1	12.3—14.0
27.0—28.9	11.1—11.6	?
25.0—26.9	9.7—11.3	13.6—14.2
23.0—24.9	8.9—11.0	11.2—13.3
21.0—22.9	7.9—10.4	11.4—12.4
19.0—20.9	7.9— 9.4	9.5—11.5
17.0—18.9	8.1— 8.7	9.4— 9.6
15.0—16.9	6.8— 8.4	8.5— 9.6
13.0—14.9	5.6— 6.7	8.4—10.0
11.0—12.9	5.9— 6.6	5.8— 8.3

From these figures it will be seen, that in practically all instances, as regards these sizes, one will be able, alone by investigating this single character, to decide which of the two forms one has to do with. With the exception of the youngest size-group the low extreme value lies, in *P. rissoi rissoi*, constantly higher than the corresponding high extreme value in *P. rissoi krøyeri*; in the youngest size-group, where this is not the case, the high value in *P. rissoi krøyeri*, 6.6 %, is found in an individual 12.8 mm. in length, the low in *P. rissoi rissoi*, 5.8 %, in an individual 11.3 mm. in length, so that the discrepancy might possibly disappear by a division into more restricted size-groups. In the isolated cases where the determination based exclusively upon this character would not be certain, the difference between the heights of the body in the two forms migth be of importance. As was the case in the larger postlarval specimens, as shown in the lists of the different measurements, the height of the body in the younger stages is as a rule distinctly greater in *P. rissoi rissoi* than in *P. rissoi krøyeri*. That this character is not here made the object of a more systematical investigation, is due to the opinion, that the preservation would have been able to alter the original value of the height of the body in a far higher degree than it would affect the length of the snout.

2. PARALEPIS COREGONOIDES Risso.

a. PARALEPIS COREGONOIDES COREGONOIDES Risso.

Coregonus Marœnula, Risso, 1810, p. 328.
Paralepis coregonoides, Risso, 1826, p. 472, fig. 15.
Paralepis coregonoides, Cuvier and Valenciennes, 1828—49, vol. VII, p. 510—12, *nec:* vol. III., p. 357.
Paralepis coregonoides, Cuvier's Règne Animal, édition illustrée, pl. 18, fig. 2.
Paralepis coregonoides, Bonaparte, 1832—41, diagnosis, excl. descript. et fig.
Paralepis Cuvieri, Bonaparte, 1832—41.
Paralepis coregonoides, Günther, 1864, vol. V, p. 418.
Paralepis coregonoides, Canestrini, 1871—72, p. 127.
Paralepis Cuvieri, Bellotti, 1877, p. 55 and 57.
Paralepis coregonoides, Moreau, 1881, p. 519—21.
Paralepis Cuvieri, Vinciguerra, 1885, ser. 2, vol. II, p. 466.
Paralepis Cuvieri, Carus, 1889—93, p. 567.
Paralepis coregonoides, Bellotti, 1891, p. 140.
Paralepis coregonoides, Moreau, 1891, p. 120.
Paralepis coregonoides, Bellotti, 1892, p. 16.
Paralepis coregonoides, Lütken, 1892, p. 226.
Paralepis coregonoides, Fage, 1910, p. 16.
Paralepis coregonoides, Ege, 1918, p. 245.
Sudis coregonoides, Parr, 1928, p. 40 (partim).

Risso's original description of the species has, by Bonaparte and several later authors, been exchanged with the name *P. Cuvieri*. Bonaparte (l. c.) compares, as mentioned under *P. Rissoi*, his *Paralepis*-specimen, described under "*P. coregonoides*", partly with Cuv. and Val.'s "*P. coregonoides*", described in the third volume of their great work, partly with the same authors' "*P. coregonoides*" described in the seventh volume. For the latter species, which differs from Bonaparte's specimen, he suggests the name of "*P. Cuvieri*", whether, as he says, it should prove to be different from Risso's two *Paralepis*-forms or, (which is less probable), it should be found to be one of his two species.

Measurements. Risso's original description of the species (1826) contains no statement of measurements, but the accompanying figure seems to show that the length of the head goes 4.2 times, the height of the body 13.0 times into the total length excl. caudal fin. The predorsal length amounts to 61.4 %, preventral length to 63.1 % of the total. The figure, likewise, shows the relatively great distance between the adipose fin and the caudal fin, the small rays of which are, however, missing.

Different measurements, taken on the figure in question in Cuvier's Règne Animal, show that the length of the head is to the total length excl. caudal fin as 1 to 3.95, the height to same as 1 to 8.5. The ventral fins are inserted below the third dorsal fin ray. Furthermore, the predorsal length amounts to 59.4 %, the preventral length to 60.6 % and the distance from the adipose fin to the foremost ray of the caudal fin to 7.0 % of the total length.

Moreau (1881, p. 519) mentions that the length of the head goes $4^1/_4$—$4^1/_2$ times, the height of the body 9—16 times into the total length incl. caudal fin, furthermore, that the insertion of the ventral fins lies now below the commencement of the dorsal fin, now below its sixth or seventh ray.

Bellotti (1891, p. 141) finds some specimens the greatest height of which is half the length of the head and others the greatest height of which amounts to one third of the length of the head. According to his experience the first are females, the others, more slender, males. The insertion of the

ventral fins is, according to his observations, situated below the third ray of the dorsal fin, and the distance between the anal and caudal fins is equal to the diameter of the eye.

LÜTKEN (1892, p. 227) has examined an individual specimen and states that the length of the head, according to this, amounts to over 1/4 of the total length excl. caudal fin.

The new material, on which the present investigation is based, includes no adult specimens, but I have had an opportunity of examining two of the collection of the British Museum, respectively 239 and 212 mm. in length. In one specimen the length of the head amounts to a little over, in the other a little under 1/4 of the total length excl. caudal fin. The greatest height goes, respectively, about 2 and 2 1/2 times into the length of the head.

On the other hand, the material contains a young specimen from Messina, 60 mm. in length, which is at such an advanced stage — the form of the body is about the same as in the adult specimens, the postlarval pigment has quite disappeared, seen from without, and the secondary pigment has spread greatly on the sides of the tail and along the entire dorsal side, likewise, the upper halves of the peritoneal pigment sections are but faintly to be seen — that it must be designated as an adolescent. Below are given the different measurements in this and in the two adult specimens; the measurements are besides expressed in percentages of the total length excl. caudal fin.

	mm.			% of Tot. ex. C.		
	1.	2.	3.	1.	2.	3.
Total length	252	225	65.5			
Total length excl. caudal fin	239	212	60.0			
Predorsal length	146	131	36.8	61.1	61.8	61.3
Preventral length	149.5	135	37.3	62.6	63.7	62.8
Preanal length	164	149	40.7	68.6	70.3	67.8
Length to origin of anal fin	189	164	45.8	79.1	77.4	76.3
Length of head	58	54.5	15.7	24.3	25.7	26.2
Length of snout	26.5	25.0	7.2	11.1	11.8	12.0
Diameter of eye	9.1	9.2	3.1	3.8	4.3	5.2
Length of dorsal fin at base	10.3	10.0	3.2	4.3	4.7	5.3
Length of anal fin at base	33.5	27.5	9.7	14.0	13.0	16.2
Distance from anal fin to caudal fin	7.0	7.4	1.7	2.9	3.5	2.8
Distance from anal fin to end of vertebral column	17.0	15.2	4.9	7.1	7.2	8.2
Distance from adipose fin to caudal fin	12.2	11.7	3.1	5.1	5.5	5.2
Distance from adipose fin to end of vertebral column	21.0	19.2	6.3	8.8	9.1	10.5
Greatest height of body	25.5	22.0	7.6	10.7	10.4	12.7
Height at insertion of pectoral fins	25.5	20.5	7.2	10.7	9.7	12.0
Height at insertion of ventral fins	22.5	19.8	6.0	9.4	9.3	10.0
Height at foremost ray of anal fin	18.2	17.7	5.1	7.6	8.3	8.5
Height at hindmost ray of anal fin	9.5	9.0	2.8	4.0	4.2	4.7

As will be seen, with the exception of the height measurements which, as mentioned, are said to vary a great deal in this species, no real disagreement can be pointed out between the adults and the young specimen.

In the two adult specimens the ventral fins are inserted respectively below the fourth and the fifth ray, in the adolescent specimen below the fourth ray of the dorsal fin.

Dentition. RISSO (1826, p. 472) gives the following description of the dentition:— "..... la mandibule ..... garnie d'un rang de fort petites dents; la mâchoire ..... hérissée de dents, les deux

antérieures plus grosses et crochues; la langue ..... garnie de pointes aiguës; le palais est lisse au milieu, couvert de chaque côté d'un osselet hérissé d'aiguillons ....."

The particular position of the species, as regards the diminutiveness of the teeth in the lower jaw, is emphasized also by Cuv. and Val. (l. c. p. 511), who remark:— "..... mais les autres dents diffèrent sensiblement: celles de la mâchoire inférieure sont très-petites et égales entre elles: il n'y en pas d'alongées en crochets entre ces petites dents ....."

Bellotti (1891, p. 141), in the specimens, the greatest height of which is half the length of the head, and which according to his experience are females, finds, at the front of the lower jaw, a curved canine followed by a row of closely placed little teeth, and in the premaxillary a row of very small closely placed teeth. In the more slender specimens, the males, the greatest height of which amounts to only $^1/_3$ of the length of the head, he finds both jaws entirely without teeth.

The two adult specimens examined by me have no teeth in the lower jaw; in the premaxillary there is a row of very small closely placed teeth. Unfortunately I had no facilities to determine the sex of the specimens.

The adolescent specimen, 60 mm. in length, from Messina, shows the following dentition (Fig. 5). Each premaxillary has in front three smaller, sligthly curved teeth (abt. 0.1 mm. long), after them follows, almost immediately above the large canine in the lower jaw, a fairly large curved tooth with the point inclining backwards (0.2 mm.), after this about 20 short teeth of a similar shape, of which the foremost (abt. 0.1 mm.) are placed at fairly large intervals from one another, while the rest (abt. 0.07 mm.) are closer together. On each palatine there are, in front, three straight, erect, large teeth (0.3 mm.), after these follow seven teeth (0.15—0.2 mm.) slightly curved towards the points, inclining somewhat backwards, after them six or seven small curved teeth, inclining backwards. The lower jaw has a large canine (0.35 mm.) close up to the point; in front of this a couple of very small teeth, after the canine follows an interval and then, with intervals between each, eleven slender erect teeth (0.15—0.25 mm., most of them 0.2 mm.). With the exception of the three hindmost they stand alone without smaller "companion teeth", at the foot of each of the three hindmost are two small teeth (abt. 0.05 mm.) and the hindmost part of the jaw has four small teeth of a similar size.

Fig. 5. *Paralepis coregonoides coregonoides* Risso. Length ex. C. 60 mm. (Messina, 1911). Premaxillary and mandibular dentition.

The average length of the larger teeth in the lower jaw — apart from the canine — amounts to 2.8 % of the length of the snout. By way of a comparison must be stated the corresponding percentages in the young specimens of the forms described in the foregoing, *viz.*, in *P. rissoi rissoi* 3.9 % and in *P. rissoi krøyeri* 3.2 %. The difference between the dentition in the adolescent specimen and in the adults, the latter as described by Cuv. and Val. and by Bellotti (applicable to the females) is, as regards the premaxillaries, approximately the same as in *P. Rissoi.* The dentition of the lower jaw differs more, in the adults — after the canine — follows a row of closely placed small teeth, in the young specimen, a row of fairly large teeth with greater intervals between each of them.

Numerical values. Risso mentions, in his original description of the species (1826), the following numbers of rays:—

D. 9, A. 22, P. 12, V. 9, C. 26, R.Br. 6.

(During the same author's description of *Coregonus Marœnula* (1810), which he himself identifies with the present *Paralepis*-species, the following values are mentioned:—

D. 10, A. 16, P. 15, V. 10, C. 20, R.Br. 7).

Cuv. and Val. give (l. c. p. 511) the following formula:—
D. 10—2 or 3, A. 3/20, P. 12, V. 1/8, C. 17, R.Br. 7.

Bellotti cites:— D. 10 + 2, A. 23.

The two adults and the adolescent specimen examined by me show the following figures:—

Tot. ex. C. mm.	D.	A.	P.	V.	R. br.	Vert.
239	11	24	15	..	..	70
212	11	24	16	..	..	70
60	11	24	15	9	8	70

In the adolescent specimen there is, moreover, found:— C. 16/19/16.

The specimens of the postlarval material are all too young to admit of the number of vertebræ being determined, just as for the same reason the rays of the fins cannot be counted, with the exception of those of the anal fin in the case of a few specimens, two from St. 15 and two from St. 133, which four specimens all have 24 rays. The number of myomeres has been investigated with the following result:—

Station No.	No. of myomeres.
10	72
11	71, 71, 72, 72, 72
15	71, 71, 72, 72, 72, 72, 73, 73
39	70, 71, 74
45	71, 71, 71, 72, 72, 72, 73, 73, 73, 74, 74
133	71, 72, 72
194	72
202	73
206	72, 73

These numbers, graphically arranged, give the figure below:—

74 o o o
73 o o o o o o o
72 o o o o o o o o o o o o o o o
71 o o o o o o o o o
70 o

The average value of the 35 figures is = 72.06. Unfortunately there are so few figures of vertebræ; but the value of the only represented variate is 2 lower than the most frequently occurring variate in the examined numbers of myomeres and corresponds, consequently, well with the average value found for the number of myomeres.

Postlarval development. Fage (1910, p. 16) mentions two specimens of *Paralepis*-larvæ, taken off Monaco, respectively 14 and 16 mm. in length, as in all probability belonging to *P. coregonoides*. He justifies this determination by the fact of his having counted 23 rays in the anal fin, but brings forward no proof for the correctness of his determination. The accompanying sketch (l. c., fig. 14), on which the internal chromatophores, characteristic of this species and also of *P. speciosus*, are, however, wanting, seems, judging by the proportional measurements, to show that the specimens cannot belong to *P. speciosus*, the other Mediterranean species with the lesser number of rays in the anal fin.

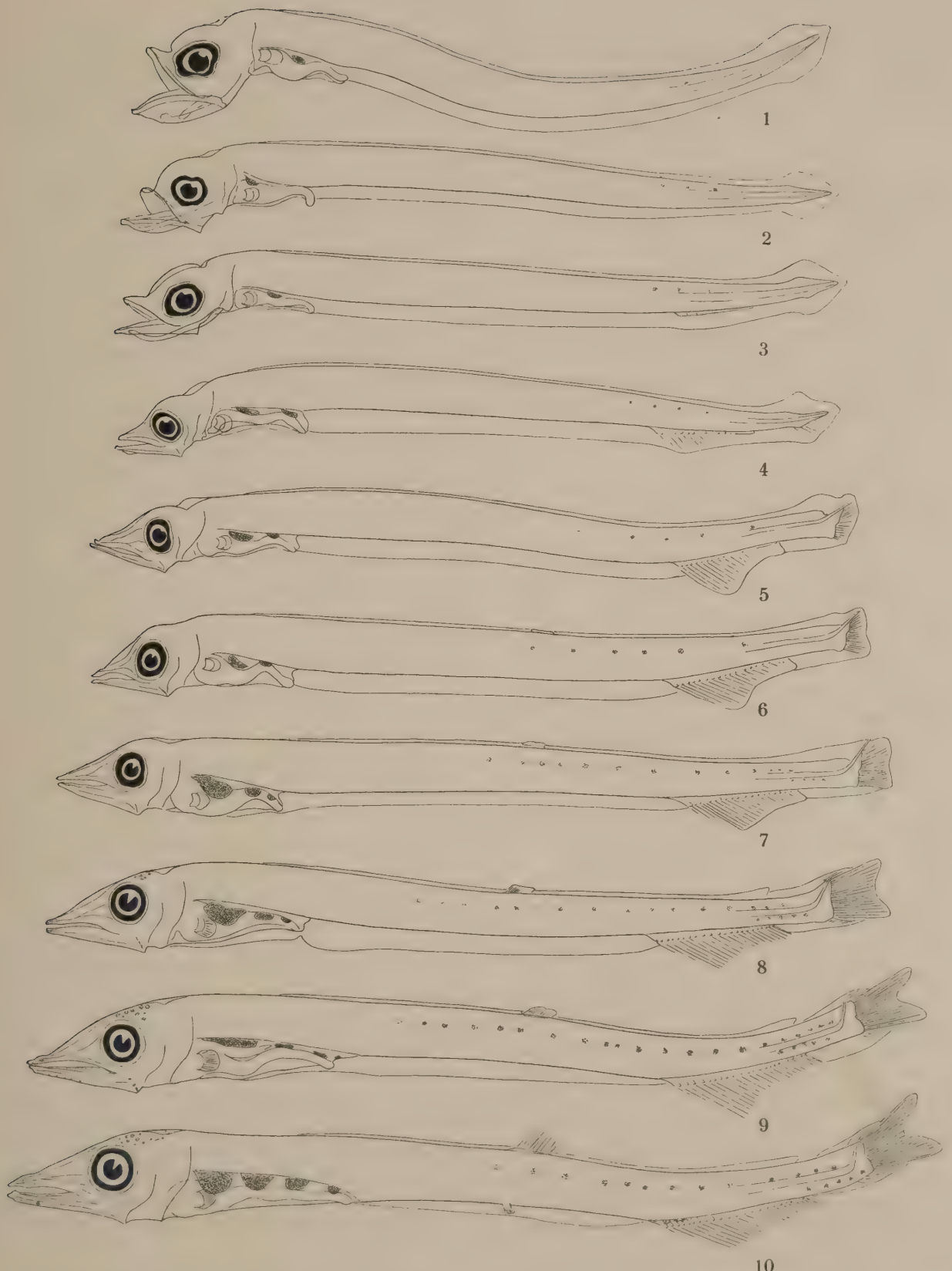


Fig. 6. *Paralepis coregonoides coregonoides* Risso. Postlarval stages, length ex. C. 1: 5 mm. (St. 11, 1908), 2: 7.5 mm. (St. 11, 1908), 3: 9. mm. (St. 11, 1908), 4: 11 mm. (St. 118, 1910), 5: 13 mm. (St. 118, 1910), 6: 15 mm. (St. 45, 1909), 7: 18.5 mm. (St. 45, 1909), 8: 19.7 mm. (St. 134. 1910), 9: 21 mm. (St. 134, 1910) and 10: 22.5 mm. (Messina, 1911).

The present figure 6 shows the postlarval development from a size of 5 mm. to a size of 22.5 mm. The material, unfortunately, contains no older postlarvæ. A synopsis must first be given of the changes which the preanal length and the length of the snout undergo from the smallest to the largest of the figured stages:—

Total length excl. caudal (mm.)	5	7.5	9	11	13	15	18.5	19.7	21	22.5
Preanal length in % of total length	30.1	25.0	26.9	26.5	27.0	26.8	28.0	31.8	36.2	39.8
Length of snout in % of total length	4.7	4.2	5.5	5.0	6.6	5.9	7.1	8.2	8.9	9.5

Fig. 6, 1 shows a specimen *5 mm.* in length. The whole of the body is surrounded by the embryonic fin. The end of the notochord is straight. No hypurals are to be seen. The pectoral fins are present and in about the same form in which they are found through all the stages here investigated. The head is comparatively large, the snout bent backwards, the eye irregularly oval. The foremost peritoneal pigment section is developed, situated about midway between the head and the anus. On the tail, rather near the end, there is a single, internal, fairly large chromatophore lying immediately up to the dorsal side of the notochord. The remainder is without pigment.

7.5 mm. (Fig. 6, 2). The preanal length is less than in the preceding stage, which is due mostly to the head being smaller. The snout is bent backwards. The peritoneum pigment has about the same size as in the preceding, on the hindmost part of the tail there are three fairly large, internal chromatophores above the notochord.

9 mm. (Fig. 6, 3). The hypurals are faintly suggested; but the end of the notochord is still straight. Pigmentation as in the preceding. The foremost part of the anal fin is faintly suggested.

11 mm. (Fig. 6, 4). The end of the notochord bends slightly upwards, the hypurals are distinctly indicated. The caudal fin is marked by a density in the embryonic fin below the hypurals. In the anal fin, the row of the interspinous rays is indicated in its entire extent and so far differentiated that these rays can be counted in the foremost half, likewise the foremost rays are suggested. The second peritoneal pigment section is developed, is somewhat smaller than the foremost, and lies at the same distance from it as from the anus. There are four chromatophores in the tail along the dorsal side of the notochord.

13 mm. (Fig. 6, 5). The end of the notochord is bent somewhat more upwards than in the preceding stage, the hypurals are so far developed that their form and relative size are suggested. In the caudal fin several rays are visible. The foremost two thirds of the number of the interspinous rays of the anal fin and about half of the rays can be counted. The row of chromatophores along the dorsal side of the notochord is augmented with yet another in front.

15 mm. (Fig. 6, 6). The end of the notochord, the hypurals, the caudal and anal fins are about the same as in the preceding stage, but a faint indication of the dorsal fin is visible. There are six chromatophores along the dorsal side of the notochord, the first situated below the dorsal fin. The chromatophores lying close up to the notochord become less distinct, gradually as the covering tissue becomes thicker; at this stage, in only the two hindmost, can anything like sharp contours be seen.

18.5 mm. (Fig. 6, 7). The posterior margin of the hypurals is about vertical to the longitudinal axis of the body, and the full number of hypurals is visible. The eye is nearly round. The majority of the long rays of the caudal fin can be distinguished. The interspinous rays of the anal fin can be distinguished with the exception of two or three of the hindmost. In the dorsal fin a faint indication of the interspinous rays is visible, the fin is besides marked by an indistinct density in the embryonic fin above this indication. There are three peritoneal pigment sections, the foremost considerably larger than in the preceding stage, the second and third, as regards size, corresponding to the two sections in the preceding stage, the hindmost being close to the anal fin. The number of chromatophores along the dorsal side of the notochord is increased to thirteen, the row begins in front of the dorsal fin and reaches almost to

the hindmost ray of the anal fin. Below the notochord four chromatophores have developed, of which the foremost is opposite to the hindmost of the dorsal row.

19.7 mm. (Fig. 6, 8). The fins are more developed than those at the preceding stage, the rays of the anal fin can all be distinguished as can also the long rays and individual short rays in the caudal fin, the dorsal fin now stands out distinctly and is differentiated in its foremost part. The embryonic fin, at this stage, stretches out close up to the head, but is interrupted, not only by the dorsal fin, but by the first indication of the adipose fin. There are three peritoneal pigment sections of the same relative size as in the preceding. The dorsolateral row of chromatophores reaches a little forward in front of the dorsal fin, in all, sixteen are visible, the ventrolateral row consists of five. The head is faintly pigmented between the eyes, on the snout and the point of the lower jaw, besides there is a short single row of tiny chromatophores along the front edge of the præoperculum.

21 mm. (Fig. 6, 9). In the dorsal fin all the rays are indicated, but the hindmost are not sufficiently developed to admit of their number being determined; the adipose fin is distinctly limited at the back. A fourth, tiny peritoneal pigment section has appeared just above the anal fin. The dorsolateral

Fig. 7. *Paralepis coregonoides coregonoides* Risso. Adolescent specimen, length ex. C. 60 mm. (Messina, 1911).

row of chromatophores consists of twenty one. On the head, besides the pigment mentioned at the preceding stage, there is a row of dotted chromatophores along the upper and a few slightly larger chromatophores along the lower edge of the lower jaw.

22.5 mm. (Fig. 6, 10). The embryonic fin still stretches out far in front of the dorsal, but is very low anteriorly, on the ventral side it is present between the anus and anal fin and is, in that region, rather considerable. The ventral fins have come in sight, but in a very slightly developed form, and are inserted further forward than in the adolescent specimen. The second and third peritoneal pigment sections have grown considerably. The foremost of the dorsolateral chromatophores are not visible outwardly, the lower row stretches out almost up to the caudal fin. On the head, the dorsal pigment has increased posteriorly.

Fig. 7 shows the previously mentioned adolescent specimen, 60 mm. in length. The specimen has approximately the form of an adult. The abdominal cavity is formed in its full length. The intestine is hidden and the anus occupies the same place as in the adult fish, a short distance behind the ventral fins. The embryonic fin has entirely disappeared, the adipose has assumed its final shape, and the small rays of the caudal are developed. The pectoral and ventral fins are developed and their rays can be counted. The measurements of this specimen have already been given. There are nine peritoneal pigment sections, five larger, in front of, and four smaller behind the ventral fins. Their limitation, as far as the ventral halves are concerned, is still distinctly visible, the wall of the abdominal cavity here being rather transparent. The secondary pigment has spread greatly on the sides of the tail and along the dorsal side. The internal chromatophores which, in the postlarval specimens, occur along the dorsal side of the notochord and, as regards the hindmost part of the tail, along the ventral side, are not visible outwardly; but, by removing the muscular tissue, one finds, in exactly the corresponding places, above and below the vertebral column, two rows of chromatophores. The dorsal row begins just beyond the interval between the third and fourth peritoneal pigment section, corresponding to the place where the foremost chromatophore in the oldest

but one of the described postlarvæ is situated; the ventral row begins almost above the middle of the anal fin and ends below the last but one vertebra. In the dorsal row some particular chromatophores seem to be obliterated so that the number cannot be determined exactly, but is computed at 35—40; the ventral row consists of eight. Along the edge of the orbit there is a narrow strip of pigment framing the lower half of the eye though stretching, at the back of the eye, somewhat further up towards the dorsal side than it does at the front of the eye; the dorsal pigment between and behind the eyes is more compact and consists of dotted chromatophores; the foremost half of the snout is pigmented.

b. PARALEPIS COREGONOIDES BOREALIS Reinhardt.

Paralepis borealis, Reinhardt, 1838, p. 115 and 125.
Paralepis coregonoides, Day, 1880—84, p. 51 and 367.
Paralepis borealis, Lütken, 1892, p. 227—31.
Paralepis borealis, Sæmundsson, 1908, p. 99 (partim).
? *Paralepis barracudina*, Fowler and Phillips, 1910, p. 403 ?
Paralepis borealis, Ege, 1918, p. 245.
Paralepis borealis, Nordgård, 1924, p. 1—7.
Paralepis borealis, Sæmundsson, 1926, p. 394 (partim); 1927 a, p. 44 (partim); 1927 b, p. 177 (partim).
Sudis coregonoides, Parr, 1928, p. 40 (partim).

The species established by Reinhardt in 1838 is mentioned earlier (1830—31, p. 20—21) by the same author, though without the addition of any specific name. He here states: — "The Greenland species approaches very close to *Paralepis coregonoides* Risso and seems to diverge from it only by a slight difference in the number of rays in some of the swimming fins and by having the eyes together with the 1st dorsal fin situated somewhat nearer to the point of the head in the Greenland individuals, which are eleven inches long.

This phenomenon ("Forekomst") has been included in the fauna of Greenland without a specific name of its own, until a complete comparison can be made with better specimens of *P. coregonoides* than are at present at hand in the museum. The species occurs both at Julianehaab and Frederikshaab" [1]).

On a basis of the said two specimens, that of Vahl from Julianehaab and that of Engholm from Frederikshaab, together with a specimen sent to the museum by Thorstenson from Iceland, Reinhardt (1838, p. 115 and 125) establishes the new species *P. borealis*, the first that was found outside the Mediterranean. He, however, gives no description or diagnosis of it beyond the above stated remarks in relation to *P. coregonoides*. It was not until 1891, that the species was made the object of a more thorough investigation by Lütken (1892, p. 227—31). A comparison between two drawings of "*Paralepis borealis* Rhdt." attracted this authors attention to the fact that he had a collective species to deal with, and led him, as before explained, to set up the new species *P. Krøyeri* Lütken. The description of this resolves itself, as regards all the characters dealt with, into a comparison between it and the original *P. borealis* Rhdt. and thus includes the real description of this as well.

Measurements. Lütken mentions the following measurements in *P. borealis*:— 1) the proportion between the length of the head and the total length exclusive of caudal fin is 1 to 4.1—4.5; 2) the ventral fins are inserted below the dorsal fin, occasionally only so far back, that their insertion corresponds to the foremost rays of that fin, but often somewhat further back, he therefore expresses a doubt that this state of things alone will always constitute a sharp borderline between the northern species; 3) the

[1]) Translated from Danish.

distance between the adipose and the foremost rays of the caudal fin is 17—18 mm. (total lengths being 265—280 mm.).

I have had an opportunity of investigating three of the specimens used by LÜTKEN during the comparison between REINHARDT's and his species, among which was one of REINHARDT's type-specimens. Moreover I have been able to investigate two specimens from Iceland. According to my measurements, the length of the head in proportion to the total length is as 1 to 4.09—4.46, the same proportion as LÜTKEN has found. The distance between the adipose and the caudal fin is likewise fairly in agreement with LÜTKEN's statement (15.5—19 mm.). The ventral fins in three of the five specimens (including the type-specimen) are inserted below the foremost rays of the dorsal fin, 3rd. to 4th, in the fourth below the 7th and in the fifth below the hindmost ray of the dorsal fin, so that I can only confirm LÜTKEN's previously mentioned opinion with regard to the value of this character.

In the largest specimen of the new material, on which the present investigation is based, and which measures 65 mm., the ventral fins are inserted below the 4th. ray of the dorsal fin and the length of the head in proportion to the total length excl. caudal is as 1 to 4.11; for the rest measurements in this and the two adult specimens mentioned are entered in the following list which, in addition, gives the values expressed in percentages of the total length excl. caudal fin; the running numbers refer to the following informations:—

No. 1. — Københavns Universitets Zoologiske Museum. — 13.10.30 No. 8 — *P. borealis* Rhdt. No. 3 — Type — Julianehaab — Vahl.
» 2. — Københavns Univ. Zool. Museum. — 1.7.65 — *P. borealis* Rhdt. No. 1 — Greenland.
» 3. — — — — — — *P. borealis* Rhdt. No. 5. — Greenland — K. M.
» 4. — Reykjavik Museum. — *P. borealis* Rhdt. No. 4. — Vestmanneyjar.
» 5. — — — — *P. borealis* Rhdt. No. 6. — Skerjafjörður.
» 6. — "Thor", St. 52, 1906, 300 m. w.

	mm.					
	1.	2.	3.	4.	5.	6.
Total length	276	292	277	288	..	67
Total length excl. caudal fin	263	278	262	275	278	65
Predorsal length	158	169	161	170	171	40
Preventral length	256	179	165	176	172	41
Preanal length	178	195	181	190	..	43.8
Length to origin of anal fin	205	218	208	216	223	50.5
Length of head	59	64.5	64	67	64	15.8
Length of snout	27	29	29	30	30	7.7
Diameter of eye	8.3	9	9	8.5	8.5	3.1
Length of dorsal fin at base	10	10.5	11	10.5	10.5	2.9
Length of anal fin at base	35	38	34	37	35	9.5
Distance from anal fin to caudal fin	12.5	13	11	14.5	..	2.1
Distance from anal fin to end of vertebral column	22	21	19	23	23	5.3
Distance from adipose fin to caudal fin	15.5	19	17	18	..	3.0
Distance from adipose fin to end of vertebral column	26	26	24	26.5	26	6.0
Greatest height of body	27	32	27	30	..	7.5
Height at insertion of pectoral fins	23	26	24	25	25	7.5
Height at insertion of ventral fins	23	28	27	29	..	5.5
Height at foremost ray of anal fin	20	23	20	24	23	5.3
Height at hindmost ray of anal fin	9.5	11	10	11	12	3.6

	% of Tot. ex. C.					
	1.	2.	3.	4.	5.	6.
Predorsal length	60.1	60.8	61.5	61.8	61.5	61.5
Preventral length	62.0	64.4	63.0	64.0	61.9	63.1
Preanal length	67.7	70.1	69.1	69.0	..	67.4
Length to origin of anal fin	77.9	78.4	79.4	78.5	80.2	77.7
Length of head	22.4	23.2	24.4	24.4	23.0	24.3
Length of snout	10.3	10.4	11.1	10.9	10.8	11.8
Diameter of eye	3.2	3.2	3.4	3.9	3.1	4.8
Length of dorsal fin at base	3.8	3.8	4.2	3.8	3.8	4.5
Length of anal fin at base	13.3	13.7	13.0	13.4	12.6	14.6
Distance from anal fin to caudal fin	4.8	4.7	4.2	5.3	..	3.2
Distance from anal fin to end of vertebral column	8.4	7.6	7.3	8.4	8.3	8.2
Distance from adipose fin to caudal fin	5.9	6.8	6.5	6.5	..	4.6
Distance from adipose fin to end of vertebral column	9.9	9.4	9.2	9.6	9.6	9.2
Greatest height of body	10.3	11.5	10.3	10.9	..	11.5
Height at insertion of pectoral fins	8.7	9.4	9.2	9.1	9.0	11.5
Height at insertion of ventral fins	8.7	10.1	10.3	10.5	..	8.5
Height at foremost ray of anal fin	7.6	8.3	7.6	8.7	8.3	8.2
Height at hindmost ray af anal fin	3.6	4.0	3.8	4.0	4.3	5.5

As will be seen, the agreement between the adults and the young specimen is generally good the lengths of the snout and the eye are, however, a little larger in the latter, moreover the height of the body is as usual somewhat divergent. The relatively great distance from the adipose fin to the caudal fin (and the end of the vertebral column) stands out distinctly, also in the young specimen.

Dentition. LÜTKEN (l. c., p. 230) mentions, during a comparison between the two species, that the tooth armament generally is weaker in *P. borealis*. The larger foremost palatine teeth and the teeth in the lower jaw are, in comparison with the corresponding ones in *P. Krøyeri*, small; the latter are partly bent backwards, partly, in the foremost part of the jaw, bent, if anything, forward. The teeth in the premaxillaries are, in part, less closely placed.

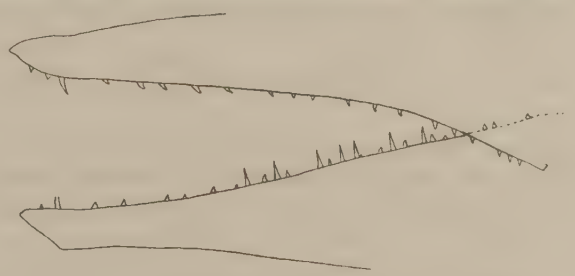


Fig. 8. *Paralepis coregonoides borealis* Reinhardt. Length ex. C. 65 mm. (St. 52, 1906). Premaxillary and mandibular dentition.

To LÜTKEN's remarks on the dentition, particularly with reference to a comparison with the undermentioned description of the dentition in the young specimens, the following must be added, as observed in the type-specimen. Each premaxillary has twenty nine small teeth (abt. 0.1 mm.), the hindmost are a little larger than the others and placed at greater intervals from each other. On each palatine there are six large teeth (abt. 0.5 mm., largest 0.7 mm.), followed by a row of small teeth. In the front of the lower jaw there is a single tooth (0.4 mm.), after an interval follow twenty one, of which nearly the foremost half are straight or slightly curved forward and smaller (0.1—0.2 mm.), while the hindmost are placed at larger intervals from each other, are strongly curved backwards and larger (abt. 0.3 mm.). The average length of the larger teeth in the lower jaw amounts to only 1.1 % of the length of the snout.

The adolescent specimen mentioned shows the following dentition (Fig. 8). The premaxillaries have, in front, a larger, slightly curved tooth (0.2 mm.) inclining backwards, in front of this a couple of

insignificant teeth and at the back, almost at the very end of the jaw, eighteen small teeth curved backwards (most of these are 0.05 mm., the foremost a little larger). On the palatines there are fourteen teeth inclining backwards and slightly curved towards the points, the size of which decreases gradually from the foremost (0.15—0.2 mm.) to the hindmost (abt. 0.05 mm.). The lower jaw has in front a canine (the point is broken off, so that the length cannot be given), after which follow, lying apart, five small erect teeth (0.05 mm.), after these seven larger erect teeth (abt. 0.2 mm.), between these a corresponding number of short ones, curved backwards (0.05—0.1 mm.). The average length of the larger teeth in the lower jaw amounts to 2.6 % of the length of the snout.

As will be seen the dentition in the specimen described differs perceptibly from that in the adult specimens. As regards the premaxillaries the difference is, however, as previously stated, about the same in all the species; whereas in the lower jaw the relative conformity does not exist, in this form either, as it did in the two subspecies of *P. Rissoi.* The larger teeth must, then, be considered peculiar to the young stages, and those occurring between them, namely, the smaller reversed teeth, to correspond to those of a similar size and form that appear in the adult individuals.

Numerical values. The five adults and also the adolescent specimen mentioned under "Measurements" show the following numbers of rays and vertebræ. The numerals indicate the same specimens as in the said section.

	D.	A.	P.	V.	C.	R. br.	Vert.
No. 1.	10	24	14	9	12/19/x	..	74
» 2.	10	24	15	9	x/19/x	8	73
» 3.	10	24	14	9	..	..	73
» 4.	10	25	15 (and 14)	9	..	..	73
» 5.	11	24	15	9	..	..	73
» 6.	10	24	15	9	15/19/16	8	73

Furthermore one specimen from Hornafjörður shows 74 vertebræ.

Of the material not previously worked up it has, in addition to the adolescent specimen, only been possible to count the number of rays in other fins besides the anal fin, and determine the number of vertebræ in two specimens with the following result:—

	Tot. ex. C.	D.	A.	P.	V.	Vert.
St. 52, 1906	50	10	24	15	9	72
» »	52	10	25	..	..	73

As regards the smaller postlarval specimens I have been able to count the rays of the anal fin in thirteen specimens from St. 1141 with the following result:—

26 o o
25 o o o o o
24 o o o o o o

average value being = 24.7, but have, however, had to content myself with determining the number of the myomeres, which has been possible in specimens larger than abt. 17 mm. In specimens from the northern stations the following numbers have been found:—

Station No.	No. of myomeres
90, 1905	75
55, 1906	75, 75, 76
61, 1906	74, 75, 76, 76

which figures give an average value = 75.3.

The large material from St. 1141 (near Madeira) has been well suitable for this investigation, the number of myomeres having been determined in 50 specimens with the following result:—

77 o o o
76 o o o o o o o o o
75 o o o o o o o o o o o o o o o o o o o o o o o o o o o o o o o o o o
74 o o o o o o o o o o o o o o o
73 o o o

The average value is = 74.90 and thus about the same as what the few figures from the northern stations gave.

In specimens from stations in the Bay of Cadiz the following numbers of myomeres have been found:—

Station No.	No. of myomeres
1107	74, 75
1108	74, 75, 75, 75, 76
1113	75, 76

with the average value = 75.0.

Specimens from St. 826 show 74, 75 and 75 myomeres, from St. 1012 (near the Azores) 75 and 76 and, finally, from St. 713 and 716 (situated in the western portion of the area of expansion) 74, 75 and 75 myomeres.

The average value of the nine figures of vertebræ before us is = 73.1. The respective average values of the figures of vertebræ and myomeres thus show a relative difference which lies very near 2, just as was the case in regard to *P. rissoi rissoi*.

Taking into consideration the above stated Synonymy the following is to be remarked:—

I have had an opportunity of examining the specimen described by Day (1880—84, p. 51 and 367) as *P. coregonoides*, taken at Polkerris in Cornwall in 1869. It is in a bad state of preservation so that the measurements cannot be determined with exactitude; the length of the head is contained about $4^1/_2$ times in the total length excl. caudal fin. Nor are the fins well preserved, with the exception of the pectoral fins which have 15 rays. The position of the ventral fins can still be seen distinctly below the 5th ray of the dorsal fin. The number of vertebræ, 73, is the usual number occurring in Reinhardt's form, likewise the length of the head, though it cannot be measured accurately, shows that the specimen must be referred to this form.

Fowler and Phillips establish (1910, p. 403—406) a new species, *P. barracudina*, on the basis of a specimen taken off Cape May County, New Jersey, 27th March 1910. Probably this specimen likewise represents Reinhardt's form. I have, however, not had an opportunity of investigating this specimen, and no statement as to the number of vertebræ is given. The head is contained 4.1 times, and the height of the body 10 times in the total length excl. caudal fin. The ventral fins are inserted below the 6th dorsal ray ("about opposite base of fourth branched dorsal ray"). The numbers of the fin rays are:— D. 11, A. 25, P. 14, V. 9. As regards the dentition it is stated *inter alia*:— "..... On each side of mandibular symphysis a small and nearly erect canine. Just behind these and well inside 1 or 2 smaller canines. A short space still posterior uniserial small mandibular teeth begin on each ramus along edges, nearly uniform small, and similar to those above except more erect, or even slightly leaning forward at anterior region ....."

The authors say that their species seems related to the European *P. coregonoides*, differing *inter alia* in all the teeth being small except the anterior on the palatines and the canines in the lower jaw. They have examined an individual Mediterranean specimen from Bonaparte's collection, which they consider to have been the basis of this author's drawing and description of "*P. coregonoides*", an assumption that agrees with the idea that the specimen examined by them is probably *P. rissoi rissoi*, for, as regards

the anal fin, 27 (?) rays are given. In the comparison with the species previously described it is further stated:— "*P. borealis* Reinhardt, said to range south in the Atlantic to Cape Ann, has been referred to a different genus, chiefly as the ventrals are inserted entirely behind the dorsal. GOODE and BEAN figure an example they refer to *P. borealis*, which shows the head $4^2/_3$, depth nearly $13^1/_2$, dorsal origin nearly last third in total length, A 29 and nearly 200 scales in a lateral count from shoulder to caudal base." As will be seen, this is a report of *P. rissoi krøyeri*, while the authors have evidently not known *P. coregonoides borealis*. The American specimen agrees with REINHARDT'S form in all the essential characters, the length of the head, height of the body, position of the ventral fins in relation to the dorsal fin, numbers of fin rays (though in REINHARDT'S form 10 is the usualnumber occurring in the dorsal fin) and dentition.

Postlarval development. HOLT and BYRNE in 1906 (1904—22, p. 200) under the title "Incertae sedis" describe a postlarval *Paralepis*-form:—" "Long-anal" Larva..... It is an elongate form characterized by a long pointed snout, very short abdomen, and by the very early development of an anal fin immediately in front of the caudal. The sides of the abdomen are decorated by a series of large black patches on each side. Towards the caudal extremity are a number of small patches of internal pigment above and below the vertebral column.

This larva may probably be related to the Stomiatidae, but it reaches a comparatively large size without approaching the characters of any adult fish known to us. It has a superficial resemblance to *Paralepis coregonoides*, but the abdomen is not longer than the head, which is sufficient to eliminate the last-named species and its allies from the list of possible parents."

In a list published later (1907, p. 2) the same authors mention a "larva" as *Paralepis* sp. and refer to the description quoted above.

As will appear from the description of the postlarval development in *P. coregonoides coregonoides* and *P. coregonoides borealis*, HOLT and BYRNE'S specimens must belong to one of these two forms. They were taken within an area of investigation situated between 46° 43′ and 47° 29′ N. lat. and between 7° 15′ and 8° 18′ W. long. and considering the locality they may fairly safely be referred to the latter.

The present figure shows the postlarval development of this form from a size of 6 mm. to a size of 22 mm., as the material does not contain older postlarvæ of this form either. The following synopsis shows the changes which the preanal length and the length of the snout undergo from the smallest to the largest of the figured stages:—

Total length excl. caudal (mm.)	6	8.8	11.8	13.5	18.0	22.0
Preanal length in % of total length	26.5	27.6	26.5	26.4	27.7	32.5
Length of snout in % of total length	abt. 4.2	abt. 4.9	4.6	5.1	7.1	8.4

The descriptions of the individual stages will, on the whole, apart from the said measurements, be a repetition of those of the corresponding sizes of the previously described form, therefore only the particulars which differ from those given will be mentioned here.

Fig. 9, 1 shows a specimen *6 mm.* in length. The head is comparatively small, the specimen is in other respects substantially the same as the specimen of the previous form 5 mm. in length.

8.8 mm. (Fig. 9, 2). There are only two dorsolateral chromatophores on the tail, in other respects the same as the specimen of the previous form 9 mm. in length.

11.8 mm. (Fig. 9, 3). The second peritoneal pigment section is very small, and there are only three dorsolateral chromatophores, in other respects the same as the specimen of the previous form 11 mm. in length.

13.5 mm. (Fig. 9, 4). Only about half of the interspinous rays of the anal fin can be counted and only a few rays distinguished, the second peritoneal pigment section is still small, in other respects the same as the specimen of the previous form 13 mm. in length.

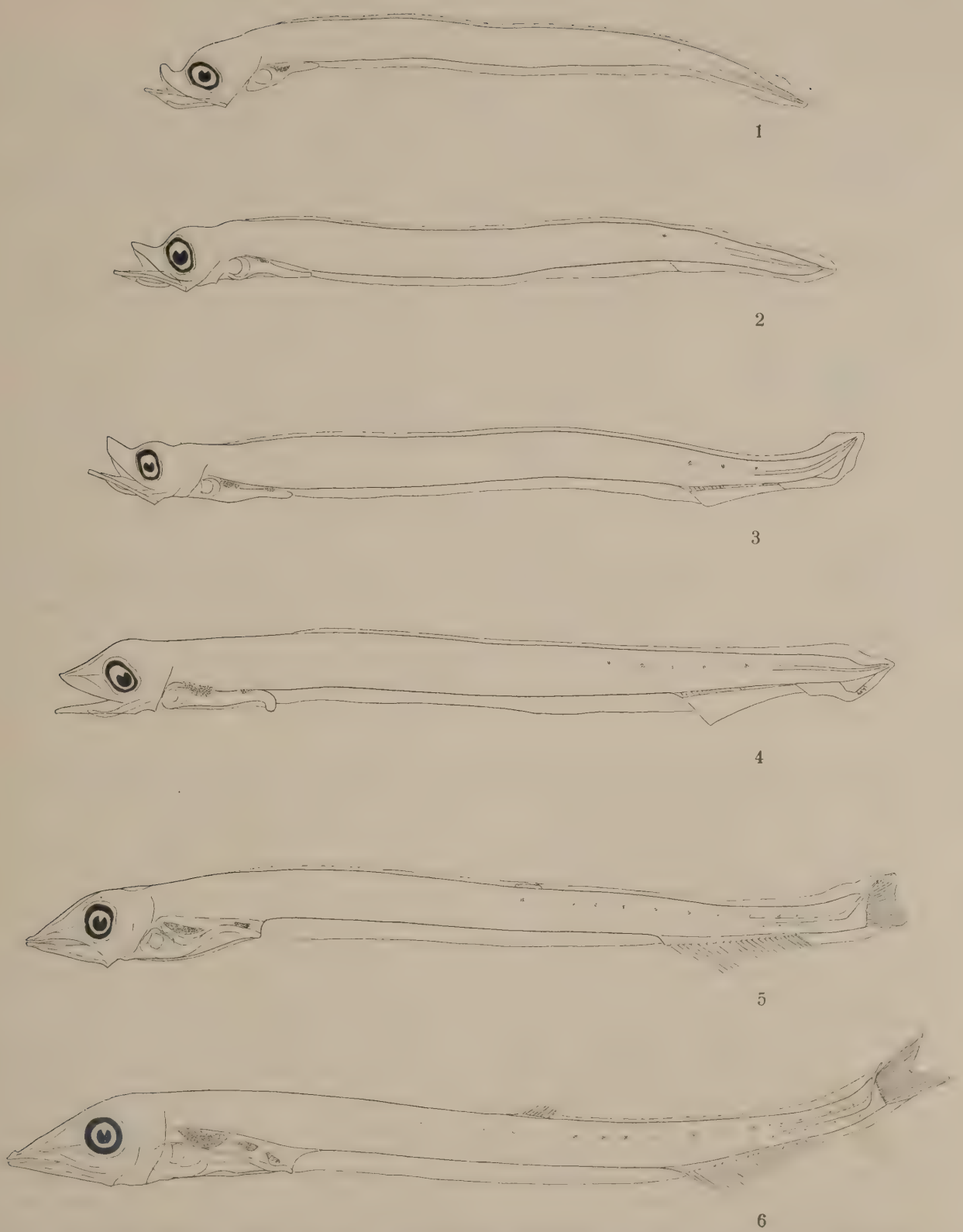


Fig. 9. *Paralepis coregonoides borealis* Reinhardt. Postlarval stages, length ex. C. 1: 6 mm. (St. 1140), 2: 8.8 mm. (St. 1141), 3: 11.8 mm. (St. 900), 4: 13.5 mm. (St. 1103), 5: 18 mm. (St. 55, 1906), and 6: 22 mm. (St. 55, 1906).

18 mm. (Fig. 9, 5). There are only two peritoneal pigment sections, in other respects the same as the specimen of the previous form 18.5 mm. in length.

22 mm. (Fig. 9, 6) No indication of the ventral fins is to be seen, the small caudal fin rays are lacking, the embryonic fin reaches from the dorsal to the caudal fin without any interruption. There are only three peritoneal pigment sections, one large and two small, the anterior dorso- and ventrolateral internal chromatophores are still to be seen from without.

Fig. 10 shows the previously mentioned adolescent specimen 65 mm. in length. As regards the development of the fins and the pigmentation, these may in all essentials be referred to the description of the adolescent specimen of the other form, though it represents a somewhat older stage. There are only

Fig. 10. *Paralepis coregonoides borealis* Reinhardt. Adolescent specimen, length ex. C. 65 mm. (St. 52, 1906).

eight peritoneal pigment sections, as the fifth evidently corresponds to the fifth plus the sixth in the other specimen, the number of sections in front of the dorsal fin are four as in the other. The secondary pigment on the sides of the tail occurs only on the dorsal half, with the exception of the posterior part of the tail, the snout and the point of the lower jaw are only slightly pigmented, while there is no pigmentation around the eye. The number of internal chromatophores above and below the vertebral column is about the same as in the specimen of the other form.

c. COMPARISON BETWEEN PARALEPIS COREGONOIDES COREGONOIDES RISSO AND PARALEPIS COREGONOIDES BOREALIS REINHARDT.

A similar relation exists between the two forms of *P. coregonoides* as between *P. rissoi rissoi* and *P. rissoi krøyeri;* but the former are in most respects less mutually divergent than these latter. With regard to the proportions both have longer head (and snout) than the two forms of *P. Rissoi,* furthermore, unlike these, the ventral fins are as a rule inserted below the foremost or middle portion of the dorsal fin, never behind it, and there is a greater distance from the adipose to the caudal fin, amounting to about 5% of the total length excl. caudal fin, while in the two forms of *P. Rissoi* this distance amounts to a little over 1 % of the same length; furthermore, the predorsal length amounts in both only to about three fifths of the total length. The head and snout are, however, longer in *P. coregonoides coregonoides* than in the other form; in the two examined adult specimens of *P. coregonoides coregonoides,* the length of the head amounts to 24.3 and 25.7 %, in the adolescent specimen to 26.2 % of the total length excl. caudal fin, while in the five investigated adult specimens of *P. coregonoides borealis,* it amounts to 22.4—24.4 %, in the adolescent specimen to 24.3 % of that length.

As regards the dentition the two forms are similar in respect of the absence of longer teeth in the lower jaw (with the exception of the canine in its anterior portion). This contrast to the two forms of *P. Rissoi* asserts itself already in the adolescent stage (the average length amounts, in *P. coregon. coregon.* to 2.8 %, in *P. coregon. boreal.* to 2.6 % of the length of the snout), though in a far lower degree than in the adult.

Concerning the numerical values the most generally occurring number of vertebræ is, in *P. coregon.*

coregon. 70, in *P. coregon. boreal.* 73. As mentioned, the material of the former was, in a numerical respect, very deficient; but the difference found between the average values of the figures of myomeres in the two forms shows that it has, nevertheless, been fairly representative. The arrangement below, which includes the entire material of both forms, demonstrates this difference:—

	P. coregon. boreal.	*P. coregon. coregon.*
77	ooo	
76	oooooooooooooo	
75	oooooooooooooooooooooooooooooooooooooo	
74	oooooooooooooooooo	ooo
73	ooo	ooooooo
72		oooooooooooooooo
71		oooooooooo
70		o
	$a_{75} = 74.95$	$a_{35} = 72.06$

The number of rays in the dorsal fin seems, however, to present a fairly great difference, as all three specimens of *P. coregon. coregon.* have 11 rays, while, of the other form, only one of the eight specimens has that number, the rest 10. The average value of the 21 figures, which the examination of the anal fin has given in *P. coregon. boreal.*, is = 24.5, while the seven specimens of the other form have all given the figure 24. Possibly the pectoral fins are also different; but the material is too small to show anything with respect to this character.

Touching the postlarvæ, attention has already been called, by the few comparative remarks which accompany the drawings of the several stages of the form last dealt with, to the fact that the same size, as far as our knowledge extends, is a little more advanced in development in *P. coregon. coregon.* than in the other. The difference is, however, too small to yield any certain means of determination in this relation. With regard to the measurements the preanal length is certainly quite distinctly greater in *P. coregon. coregon.* in specimens 20—22 mm. in length, but below that size it is the same in both forms. The length of the snout, which was very adaptable for the purpose of distinguishing the two forms of *P. Rissoi*, shows little or no difference between the two present forms as will be seen by a comparison between the previously mentioned measurements in the figured specimens, expressed in percentages of the total length excl. caudal fin:—

	Tot. mm.	L. of snout % of Tot.	Tot. mm.	L. of snout % of Tot.	Tot. mm.	L. of snout % of Tot.	Tot. mm.	L. of snout % of Tot.
P. coregon. coregon.	9	5.5	11	5.0	13	6.6	18.5	7.1
P. coregon. boreal.	8.8	abt. 4.9	11.8	4.6	13.5	5.1	18.0	7.1

The best character seems to be the number of myomeres; it is true that the two forms, as will be seen, have two variates in common so that the single individual cannot in all cases be determined by means of this character. The difference between the respective average values is, however, so great that the examination of a small number of individuals will be sufficient for a determination.

The number of myomeres can be determined in specimens larger than about 15 mm. The specimens entered in the records of hauls under this minimum length are therefore referred to the form which larger specimens, derived from the same or an adjacent locality, have, through the determination of the number of myomeres, proved to belong, an obviously unsatisfactory, but, in this case, the only possible method.

3. PARALEPIS SPECIOSUS Bellotti.

Paralepis speciosus, Bellotti, 1877, vol. XX, p. 54 and 57, fig. p. 57.
Paralepis coregonoides, Moreau, 1881, vol. III, p. 519.
Paralepis speciosus, Vinciguerra, 1885, ser. 2, vol. II, p. 468.
Paralepis speciosus, Moreau, 1891, p. 118.
Paralepis speciosus, Bellotti, 1891, p. 139 and 1892, p. 16.
Omosudis elongatus, Zugmayer, 1911, p. 18—20 (partim), pl. I, fig. 6.
Paralepis speciosus, Pietschmann, 1914, p. 440 (partim), Taf. VI, Fig. 4, *nec.*: Taf. VI, Fig. 3, *nec.*: Taf. V, Fig. 1.

Bellotti establishes (1877) his species on two specimens 75 and 90 mm. in length, taken at Nice. Among other things he mentions that the scales are lacking (but means that they are "decidue"), and that seven large black patches [the peritoneal pigment sections] occupy the lower half of the body from the operculum to the anal region, a state of things which, when the development in the other species is taken into consideration, must lead to the opinion that Bellotti's specimens are at a juvenile, adolescent stage.

Moreau (1881, p. 519) gives *P. speciosus* as a synonym for *P. coregonoides*, but later on (1891) treats Bellotti's species as a separate one, though with some doubt; he concludes his comment on it thus (p. 120):— "La concordance qui existe dans la formule des nageoires, dans l'ensemble des proportions chez le Paralépis élégant et chez le Paralépis corégonoïde, porte à croire qu'ils sont le premier le jeune le second l'adulte d'une même espèce."

Zugmayer's determination will be further commented on under the description of the postlarval development.

Measurements. Bellotti mentions the following:— The length of the head is contained four times in the total length excl. caudal fin, the ventral fins are hardly ("appena") inserted in front of the first ray in the dorsal fin, the distance from the anal to the caudal fin is equal to the diameter of the eye, the pectoral fins are twice as long as this. Moreau likewise finds, in a specimen 83 mm. in length, that the length of the head amounts to a fourth of the total length and that the ventral fins are inserted below the first ray in the dorsal fin.

I have examined two specimens in the collection of the British Museum, derived from Messina, 52 and 66 mm. long. The length of the head in the larger specimen is contained 3.6 times in the total length excl. caudal fin, the ventral fins are inserted below the 2nd—3rd rays in the dorsal fin. In the following it is compared with a specimen 29.6 mm. in length, the largest to be found in the collections of the "Thor". The head in this younger specimen, which, however, is already so far developed that it may be designated adolescent, is longer as it is contained 3.2 times in the total length excl. caudal fin; the ventral fins are inserted below the 3rd ray in the dorsal fin. The various measurements of the two specimens are also expressed in percentages of the total length excl. caudal fin.:—

	mm.		% of Tot. ex. C.	
	1.	2.	1.	2.
Total length	66	32		
Total length excl. caudal fin	62	29.6		
Predorsal length	37	18.4	59.7	62.2
Preventral length	37.5	18.6	60.5	62.8
Preanal length	42.3	..	68.2	..
Length to origin of anal fin	48.5	23.0	78.2	77.7
Length of head	17.2	9.2	27.7	31.1
Length of snout	7.0	3.7	11.3	12.5
Diameter of eye	3.5	2.1	5.6	7.1

	mm.		% of Tot. ex. C.	
	1.	2.	1.	2.
Length of dorsal fin at base	3.1	1.7	5.0	5.7
Length of anal fin at base	10.0	4.8	16.1	16.2
Distance from anal fin to caudal fin	1.5	0.7	2.4	2.4
Distance from anal fin to end of vertebral column	4.5	2.3	7.3	7.8
Distance from adipose fin to caudal fin	3.0	1.2	4.8	4.1
Distance from adipose fin to end of vertebral column	5.9	3.0	9.5	10.1
Greatest height of body	8.0	4.0	12.9	13.5
Height at insertion of pectoral fins	7.0	4.0	11.3	13.5
Height at insertion of ventral fins	5.8	2.2	9.4	7.4
Height at foremost ray of anal fin	4.9	2.1	7.9	7.1
Height at hindmost ray of anal fin	2.8	1.3	4.5	4.4

As will be seen, the younger specimen, except for its somewhat larger head, differs but very slightly from the other, the eye is larger and the height of the body slightly divergent, the height of the tail is, on the contrary, well in agreement with that in the larger specimen.

Dentition. Bellotti states that the lower jaw is furnished with teeth in the same manner as in *P. Rissoi* and in *P. sphyrænoides*, namely with teeth that are long, pointed, unequal and placed at larger intervals from one another.

Moreau writes (p. 118):— "La mâchoire supérieure est un peu moins longue que la mandibule; elles sont l'une et l'autre garnies d'une série de petites dents pointues; il y en a quelques-unes en fins crochets sur le devant de la mâchoire supérieure." Excepting that he mentions that some of the teeth in the premaxillaries, to the front, are curved, he seems consequently to be of opinion that the teeth in the premaxillaries and lower jaw are alike, while the real state of things, as emphasized by Bellotti, is that the hindmost three quarters of the teeth carrying portion of the lower jaw is furnished with fairly large teeth placed at equal intervals from each other and accompanied, in some cases, by smaller teeth, a similar arrangement to that found in *P. Rissoi*.

The fairly large specimen, 62 mm. in length, examined by me shows the following arrangement. The anterior halves of the premaxillaries are occupied by slender teeth curving towards the points, of which those in front are about equally as long as the larger ones in the lower jaw; the posterior halves are occupied by a row of low, triangular teeth close up against one another. To the front, on each side of the lower jaw, there is a curved canine, after a short interval eight fairly large erect teeth, accompanied in some cases by smaller ones.

Fig. 11. *Paralepis speciosus* Bellotti. Length ex. C. 29.6 mm. (St. 115, 1910). Premaxillary and mandibular dentition.

By way of comparison I give a description of the dentition in the fairly young specimen, 29.6 mm. in length (Fig. 11). Each of the premaxillaries has in front four fairly large teeth with the points slightly curved, inclining more or less backward (0.2—0.3 mm. in length), besides twelve small curved ones, inclining backward with a diminishing distance between one another from the foremost to the hindmost (abt. 0.1 mm.). Each of the palatines is furnished with fourteen teeth, of which the two foremost are fairly large (abt. 0.2 mm.) and have larger intervals between each other than the rest (abt. 0.07 mm.). In the front of the lower jaw there is a curved canine

(0.3 mm.) on each side, in front of this a tooth of a similar shape but only half the length, after a short interval a couple of small teeth (abt. 0.1 mm.) and then six fairly large erect, straight and slender teeth (abt. 0.2 mm.) at intervals corresponding to the length of the teeth; close up to each of these is a smaller tooth (abt. 0.1 mm.), only the hindmost of the larger teeth has two such "companion teeth".

The average length of the larger teeth in the lower jaw amounts to 5.4 % of the length of the snout, that is to say, almost twice the value of what is found in specimens at about the corresponding stage of the two forms of *P. coregonoides* (respectively 2.8 and 2.6 %); from this species, which *P. speciosus*, however, seems most closely related to, it consequently differs, in this respect, more than from *P. Rissoi*.

Numerical values. Bellotti mentions only the number of rays as far as the three fins are concerned, *viz.*:—

D. 10, A. 22, V. 9.

Moreau gives the following formula:—

D. 10; A. 22 à 24; C. 9 à 10/20/11 à 12; P. 13; V. 8 à 9.

The two fairly large specimens which I had an opportunity to examine had not the fins so well preserved that reliable numbers of rays could be got; whereas the number of vertebræ could be determined with certainty in the larger specimen to 69 and with some doubt in the smaller to 67. The new material on which this investigation is based has given the following figures:—

Station No.	Tot. ex. C. mm.	D.	A.	P.	V.	C.	R.br.	Vert.
115	30	11	24	16	9	16/19/17	8	69
»	24	11	24	..	.	x/20/x	8	69
»	22	..	..	..	.	..	.	67
129	21	11	..	..	.	..	7	..
206	26	11	23	15	9	x/19/x	8	..
»	24	10	24	..	.	x/19/x	8	..
»	20	11	24	..	.	..	.	70
»	20	11	24	..	.	..	8	..
»	19	11	..	..	.	..	7 (and 8)	70
»	18	..	..	..	.	..	.	68
209	27	11	24	16	.	x/19/x	8	69
»	24	..	..	..	.	..	.	70
»	21	11	24	..	.	..	8	69
»	21	11	24	..	.	..	8	..
»	19	11	24	..	.	..	.	68

The material, both of this species and of *P. coregonoides coregonoides*, is scanty, but large enough to show that there can hardly be any difference of importance between the two forms with regard to the number of rays in the fins; whereas the number of vertebræ is a little lower in *P. speciosus*. The above numbers of vertebræ found in this species together with the previously mentioned number, 69, in the larger specimen, form the following graph:—

70 o o o
69 o o o o o
68 o o
67 o

The average value of the 11 figures is = 68.9. For *P. coregon. coregon.* there were only three figures of vertebræ (in all three specimens 70), whereas a greater number of figures of myomeres the average value of which (72.1) shows that 70 is the most frequently occurring number in this form, while this number in *P. speciosus* is the highest found, though the above graph shows that a larger material might give the figure 71.

Postlarval development. ZUGMAYER (1911, p. 18—20) mentions eight postlarval specimens, 12—26 mm. in length, taken by the Monaco research vessel the "Princesse-Alice" on her cruises in 1904—05 and 1908—09, partly in the Atlantic and partly in the Mediterranean. His determination of these specimens as "*Omosudis elongatus* Brauer" is, at any rate as far as concerns the two specimens I have had an opportunity to examine, incorrect.

The form described by BRAUER (1906, p. 140) as a new species of the genus *Omosudis* and which was taken by the "Valdivia" in the Gulf of Guinea around the equator and also in the Indian Ocean is, first by PIETSCHMANN (1914) and later by others, REGAN (1916) and PARR (1928), specifically identified with *Paralepis speciosus*. There seems to be no possible objection to the form being referred to the genus *Paralepis*, but, as the data before us establish sufficiently clearly, it is specifically different from *P. speciosus*:—

	Paralepis speciosus	*"Omosudis elongatus"*
P.	15—16	12
A.	(22 + 1) 23—24 (23 + 1)	25—26

Moreover, two almost equally large specimens of the two forms show the following mutual differences:—

	Paralepis speciosus	*"Omosudis elongatus"*
Total length excl. caudal	32 mm.	30 mm.
Length of head to total length as	1 to 3.22	1 to 3.7
Ventral fins are inserted	below 3rd or 4th ray of dorsal fin	a little in front of dorsal fin
Origin of dorsal fin is above	5th	7th peritoneal pigment section
Each premaxillary has in front	4 fairly large teeth	1 large tooth

One of ZUGMAYER's specimens from St. 2695 (1908), 38° 35′ N. lat., 3° 06′ W. long. (the Mediterranean) shows a perfect agreement with the youngest of the below described specimens of *P. speciosus* from the collections of the "Thor", while ZUGMAYER's specimen from St. 1800 (1904), 32° 18′ N. lat., 23° 58′ W. long., the second one of his examined by me, is a postlarval specimen of his own species *P. brevis*, described in the same publication, as will be further pointed out in the following. His remaining six specimens I have not been able to examine, but it is almost assumable that the other specimens from the Mediterranean belong either to *P. speciosus* or to *P. coregon. coregon.* (this latter assumption being the most probable as regards the two specimens 22 mm. long which are stated to lack the dorsal fin). The second specimen from the Atlantic station 1800 (1904) is, I should say, to be referred to the same species as the one I examined, it cannot in any case be *P. speciosus*, the specimens of which are not, as the specimen in question is stated to be, furnished with all the fins, as long as they measure only 12 mm. This state of things, the blending together of two, perhaps several, species, explains the remarkable disagreement that ZUGMAYER finds, in respect of size and development, among the eight specimens. Referring to the synopsis he (p. 19) gives of the development of the fins and teeth and also of the number of the peritoneal pigment sections, he remarks:— "Ce tableau montre que, quand les subdivisions du péritoine sont nombreuses, les nageoires sont toutes présentes; nous avons donc probablement là des poissons moins jeunes, quoique ces spécimens soient parfois plus petites que les autres où ces conditions ne se rencontrent pas. La dentition ne donne toutefois aucun point de repère pour la division en groupe, pas plus que la longueur et la provenance. Il faut donc admettre que la croissance est individuellement très variable."

Tate Regan (1916, p. 138), somewhat doubtfully, refers a larva 8 mm. long, taken by the "Terra Nova" expedition at 29° 10′ N. lat., 33° 36′ W. long. on the 29th of May 1913, to *P. speciosus*. Unfortunately I have not seen this specimen, but do not consider it probable that the determination can be correct. It is reported to have five peritoneal pigment sections on each side, while an individual twice as long, the smallest specimen in the material I have had at my disposal, has only six such sections, the hindmost of which is still quite small. If one takes into consideration the proportion in this respect between the sizes in specimens at corresponding stages in the other species, it is not reasonable to assume that a specimen 8 mm. in length should already have five peritoneal pigment sections developed.

Regan remarks that there is reason to think that *P. speciosus* is a small species, considering that the largest known specimen is only 90 mm. long. (Pietschmann (1914), however, states that the museum in Vienna is in possession of several somewhat larger specimens, greatest length 149 mm.). The specimens at the different postlarval stages are certainly far smaller than those of the species described above, at corresponding stages of development; that this circumstance needs not be tantamount to the species attaining an inferior size, is amply exemplified by Zugmayer's *P. brevis*.

Pietschmann (1914, p. 440) has, under the name *P. speciosus*, described three postlarval specimens, respectively 22, 22.5 and 35 mm. long, and has figured the larger ones. The large specimen (Taf. VI, Fig. 3) must, however, as previously stated, be referred to *P. rissoi rissoi* the characteristic tail pigment of which stands out distinctly in the drawing. Besides, *inter alia* the smallness of the eye (especially the diameter of the eye in proportion to the length of the snout), the relatively small height of the body and the short base of the dorsal fin, should be sufficient to show that the specimen cannot belong to *P. speciosus*.

The following description of the development includes three stages. The middle one of these, represented by a specimen 23.5 mm. in length, is the same as that described and figured by Pietschmann (Taf. VI, Fig. 4); as the said author, however, in consequence of the badly preserved state of the specimens, has been obliged to confine himself mainly to describe the pigmentation, it is expedient to include this stage as well.

The synopsis below shows the preanal length and the length of the snout in the three figured specimens expressed in percentages of the total length excl. caudal fin:—

Total length excl. caudal (mm.)	16.5	23.5	29.6
Preanal length in % of total length	56.1	55.3	67.8
Length of snout in % of total length	11.7	10.6	12.5

The length of the snout has thus, in the youngest specimen, reached the length one finds in the larger, adolescent, specimens (in the more fully examined one, 62 mm. in length, it amounted to 11.3% of the total), and the preanal length is comparatively very little removed from the final value.

Fig. 12, 1 shows a specimen *16.5 mm.* in length. The unpaired fins are already very developed, the rays in the dorsal fin can be counted, in the anal fin all the rays, with the exception of the 2—3 hindmost, can be distinguished, the large rays in the caudal fin can be counted, and a number of the small rays are suggested. The embryonic fin is seen, dorsally, only behind the dorsal fin, the adipose fin is distinctly defined; ventrally the embryonic fin stretches from a point near the head to the anal fin and also between this and the caudal fin. The pectoral fins are indicated but are yet at an undeveloped stage, and the rays cannot be distinguished, the ventral fins are lacking. There are six peritoneal pigment sections, of which the foremost, as in the other species, is the largest; the proportions between the three anterior are about the same as at the older stages, whereas the three posterior are all of insignificant dimensions. Along the dorsal side of the vertebral column there is a row of stellate chromatophores which, seen from without, has the appearance of a dorsolateral row of small patches stretching from a point almost above the interval

between the second and the third peritoneal pigment section to nearly as far as the hindmost edge of the tail. Opposite the posterior portion of this row there is a ventrolateral row consisting, seen from without, of five small patches which, likewise, represent stellate chromatophores, and stretching along the ventral side of the vertebral column. Along the dorsal side of the anterior part of the trunk there is a row of small chromatophores, furthermore there is a patch of pigment above the brain and one on the point of the snout.

23.5 mm. (Fig. 12, 2). The rays of the anal fin are distinctly visible, the adipose fin stands out sharply but still goes in front evenly into the embryonic fin which, as in the preceding stage, reaches close up to the

Fig. 12. *Paralepis speciosus* Bellotti. Postlarval stages, length ex. C. 1: 16.5 mm. (St. 209, 1910), 2: 23.5 mm. (St. 206, 1910), and an adolescent stage, 3: 29.6 mm. (St. 115, 1910).

dorsal fin and still connects the adipose with the caudal fin; ventrally the embryonic fin is seen a little in front of the anus and reaches backwards to the caudal fin interrupted by the anus and anal fin. Most of the rays of the pectoral fins can be distinguished, the first indication of the ventral fins is seen close to the anus below the foremost rays of the dorsal fin. There are eight peritoneal pigment sections, the size of which decreases rather evenly from the foremost to the hindmost, individually occupying, besides, their approximately final places, thus the fifth reaches in below the foremost part of the dorsal fin as in older individuals and in Bellotti's type-specimen; the two hindmost are very small and indistinct. Otherwise the pigmentation is about the same as in the preceding stage, the dorsal row of chromatophores on the anterior part of the trunk is somewhat lengthened.

Fig. 12, 3 shows an adolescent specimen *29,6 mm.* in length. The dorsal portion of the embryonic fin has almost disappeared, ventrally there are still remnants in front of the ventral fins and between the anus and the anal fin. The ventral fins are developed and their rays can be counted, which is also the case as regards the pectoral fins. The wall of the abdominal cavity is so far formed that one can only indistinctly distinguish the lower contour of the intestinal canal. In front of the ventral fins five fairly large peritoneal pigment sections are visible, behind these a small short and a long narrow section, the latter most likely representing two. The chromatophores along the vertebral column are not visible from without. The dorsal pigment which in preceding stages was represented by a single row of chromatophores in front, now stretsches as a narrow belt along the entire back, right up to the caudal fin. Besides, on the side of the tail, beginning in front almost above the origin of the anal fin, there are some small stripes of pigment which run parallel with the dorsal and, in part, the ventral halves of the myomeres. The pigment over the brain has increased in extent and density.

In connection with the treatment of this species the following is to be remarked:—

Parr (1928, p. 42) mentions, under the designation *Lestidium* (*Bathysudis*) *speciosum* Bellotti 1877, a juvenile specimen of a *Paralepis*-form which unfortunately is not represented in this collection and has therefore not been made the object of further comment than the particulars given by the said author allow.

As previously stated, in placing the form outside the range of the genus *Paralepis*, regard has been paid principally to its being devoid of scales, a circumstance which should place it in contradistinction to the *Paralepis*-species, but which, however, is found in juvenile specimens of all the known species of this genus. The using of the above stated designation for the genus is thus due to the said author's lack of knowledge of the ontogenetic development within this genus.

As the specific name signifies, the form is referred to Bellotti's *Paralepis*-species. Parr, however, does not find a complete agreement in respect of certain proportions, particularly that between the diameter of the eye and the length of the snout, and says that this difference might perhaps warrant the consideration of the form as a new subspecies, "*brevirostris*". However, he finds — according to statements in the literature — a great variation in the species in respect of the proportions between the different parts of the head and the body. This variation is due, as pointed out in the foregoing, to the blending together of different species which previous authors (Zugmayer, Pietschmann and Regan) have been guilty of.

A comparison between the measurements given by Parr and the corresponding ones found in a specimen of *P. speciosus*, of somewhat the same size, expressed in % of the total length excl. caudal fin, shows, as will be seen, fairly great differences:—

	Parr's specimen	*P. speciosus*
Total length excl. caudal (mm.)	53	62
Predorsal length	60.4	59.7
Preventral length	64.2	60.5
Length to origin of anal fin	77.4	78.2
Length of head	24.5	27.7
Length of snout	9.4	11.3

Both the length of the head and that of the snout are thus considerably greater, while the preventral length is less in *P. speciosus* than in Parr's form; the ventral fins in the latter are consequently inserted below the hindmost part of the dorsal fin. Furthermore the number of peritoneal pigment sections is larger in Parr's form as, according to the drawing, it has ten separated sections, while *P. speciosus* has only 8 (7) such sections.

With reference to the number of rays in the fins it is only mentioned that the dorsal fin has "about 11", the anal fin "about 21 rays". The number of vertebræ is reported by Parr (1929, p. 32) to

be 66, which number according to my way of counting becomes 65, as I count the last upward bending portion of the vertebral column as one, PARR as two, vertebræ. For a comparison it must be borne in mind that from 67 to 70 vertebræ have been found in *P. speciosus* and that the two forms are thus different in this respect as well.

Through the elucidation of these many differences the establishment of a new species on a basis of the specimen mentioned will be satisfactorily justified; the designation of the new species should naturally be *Paralepis brevirostris*, (Parr) sp. n.

4. PARALEPIS BREVIS Zugmayer.

Paralepis coregonoides, Johnson, 1862, p. 283—84.
Paralepis sphyrænoides, Günther, 1864, vol. V, p. 418 (partim).
Paralepis coregonoides, Goode and Bean, 1895, p. 119, pl. 39, fig. 149.
Paralepis borealis, Sæmundsson, 1909, p. 99 (partim).
Paralepis brevis, Zugmayer, 1911, p. 61, pl. II, fig. 7.
Omosudis elongatus, Zugmayer, 1911, p. 18—20 (partim).
Paralepis borealis, Sæmundsson, 1926, p. 394 (partim); 1927a, p. 44 (partim); 1927b, p. 177 (partim).
Sudis bronsoni, Parr, 1928, p. 36, fig. 3.
Paralepis coregonoides (sensu lat.), ROULE and ANGEL, 1930, p. 62 (partim), pl. III, fig. 81, 82, 83 and 84, *nec:* fig. 80.

ZUGMAYER (1911, p. 61) establishes his new species on the basis of a specimen taken by the "Princesse-Alice" on the 5th of September 1910 at St. 3030 (37° 10′ N. lat., 11° 48′ W. long). He finds this specimen diverging so much from those hitherto known that he regards it as representing a new species "malgré la systématique peu claire de ce genre et la subtile différenciation des espèces". He lays stress on the weak dentition and on the form of the scales of the lateral line, which consist of a fairly narrow anterior and a broader posterior part which is furnished with only a single opening, but remarks, however, that in these respects it agrees with *P. atlanticus* Krøyer. On the other hand he considers the new species occupying a particular position by its proportions.

Measurements. ZUGMAYER mentions that the greatest height of the body is only contained 7 times in the total length without the caudal fin, and that the proportion between the length of the head and the total length is 1 to 3.95. I have had an opportunity of examining the type-specimen and have found the latter proportion to be 1 to 3.83, a difference from ZUGMAYER's result which, presumably, is due to a correction of the total length excl. caudal fin which the X-ray photograph has made possible. The proportion between the height and length I find somewhat more divergent from that stated by ZUGMAYER, namely 1 to 7.83, a disagreement which may easily be due to the preservation. Like ZUGMAYER, I find that the ventral fins are inserted below the 3rd ray in the dorsal fin. In the following will be mentioned different measurements in the type-specimen and in five other specimens, the measurements are also expressed in percentages of the total length excl. caudal fin. The appended running numbers refer to the following informations:—

No. 1. — Musée Océanographique Monaco. — *Paralepis brevis* Zugmayer — Type.
» 2. — Reykjavik Museum. — Grafarvogur, Iceland.
» 3. — Göteborg Naturhistoriska Museum, Pi. 2216 — 15′ N. W. of Skagen, 3.9.1926.
» 4. — British Museum, 62.2.5.4 — Madeira — J. Y. Johnson.
» 5. — U. S. Nat. Museum, 37860 — 28° 43′ N. lat., 87° 14′ W. long. — "Albatross".
» 6. — "Dana", St. 1156, 1921, 3000 m. w.

mm.

	1.	2.	3.	4.	5.	6.
Total length	361	447	abt. 560	186	87	59
Total length excl. caudal fin	329	415	503	175	83	54.5
Predorsal length	195	250	308	106	51	33
Preventral length	199	256	315	104	52.5	33.7
Preanal length	220	..	343	..	55	35.6
Length to origin of anal fin	255	327	400	137	65	42.5
Length of head	86	105	129	47	23	16.1
Length of snout	41	51	66	..	10.8	8.1
Diameter of eye	15.0	16	20	..	4.8	3.0
Length of dorsal fin at base	17.5	19	27	..	3.7	2.2
Length of anal fin at base	49.5	55	71	..	10.7	7.3
Distance from anal fin to caudal fin	11.0	16	18	..	3.2	1.4
Distance from anal fin to end of vertebral column	26	31	35	..	6.9	4.5
Distance from adipose fin to caudal fin	17.5	27	31	..	4.0	2.5
Distance from adipose fin to end of vertebral column	32	39	45	..	8.2	5.2
Greatest height of body	42	48	66	..	10.0	6.5
Height at insertion of pectoral fins	38	43	60	..	9.0	6.5
Height at insertion of ventral fins	36	45	64	..	9.2	..
Height at foremost ray in anal fin	31	38	48	12.5	6.0	4.2
Height at hindmost ray in anal fin	15	18	21	..	3.2	2.4

% of Tot. ex. C.

	1.	2.	3.	4.	5.	6.
Predorsal length	59.3	60.2	61.2	60.6	61.4	60.6
Preventral length	60.5	61.7	62.6	59.4	63.3	61.8
Preanal length	66.9	..	68.2	..	66.3	65.3
Length to origin of anal fin	77.5	78.8	79.5	78.3	78.3	78.0
Length of head	26.1	25.3	25.6	26.9	27.7	29.5
Length of snout	12.5	12.3	13.1	..	13.0	14.9
Diameter of eye	4.6	3.9	4.0	..	5.8	5.5
Length of dorsal fin at base	5.3	4.6	5.4	..	4.5	4.0
Length of anal fin at base	15.0	13.3	14.1	..	12.9	13.4
Distance from anal fin to caudal fin	3.3	3.9	3.6	..	3.9	2.6
Distance from anal fin to end of vertebral column	7.9	7.5	7.0	..	8.3	8.3
Distance from adipose fin to caudal fin	5.3	6.5	6.2	..	4.8	4.6
Distance from adipose fin to end of vertebral column	9.7	9.4	8.9	..	9.9	9.5
Greatest height of body	12.8	11.6	13.1	..	12.0	11.9
Height at insertion of pectoral fins	11.6	10.4	11.9	..	10.8	11.9
Height at insertion of ventral fins	10.9	10.8	12.7	..	11.1	..
Height at foremost ray in anal fin	9.4	9.2	9.5	7.1	7.2	7.7
Height at hindmost ray in anal fin	4.6	4.3	4.2	..	3.9	4.4

It will be seen that the length of the head (and of the snout) increases to a considerable extent from the large specimens to the smallest one; in connection with this the diameter of the eye is also larger in the two smallest specimens. Otherwise no difference of any importance can be pointed out between the six specimens. As it appears from the slight difference between the predorsal and the preventral length, the ventral fins are situated far forward below the dorsal fin; in the type-specimen they were

inserted below the 3rd ray of the dorsal fin, in No. 2 below the 3rd—4th, in No. 3 below the 5th, in No. 5 below the 5th and in No. 6 below the 4th ray of the dorsal fin; JOHNSON's specimen is so badly preserved that a displacement may have taken place, the ventral fins seem, however, to be below the foremost rays of the dorsal fin.

The species, as pointed out by ZUGMAYER, seems to occupy a particular position with regard to the length of the head. *P. speciosus*, which in that respect resembles it in highest degree, seems to have a somewhat shorter head, as it appears from the comparison between the larger one of the measured specimens of this species (27.7 % of the total length) and No. 6 of the *P. brevis*-specimens (29.5 % of the total length), which two specimens may be assumed to be at stages of development which are not very different from each other. On the other hand *P. brevis* seems to have almost the same height of body as *P. speciosus*.

Dentition. The dentition in ZUGMAYER's specimen is very weak. The premaxillaries are without teeth in front, in the two hindmost thirds of each there are about 40 tiny teeth (abt. 0.2 mm.), for the greater part in pairs, fairly large intervals alternating regularly with quite insignificant ones. The palatines have two fairly large teeth (1 mm.) in front followed by thirteen small ones. The lower jaw is, on the middle portion of the dentary, furnished with a few tiny teeth (smaller than 0.1 mm.), among these, in the left side, there are two somewhat larger teeth curved backwards (abt. 1 mm.), in the right side four (abt. 0.5 mm.).

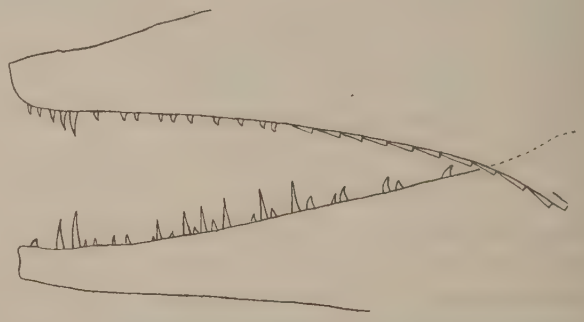


Fig. 13. *Paralepis brevis* Zugmayer. Length ex. C. 54.5 mm. (St. 1156). Premaxillary and mandibular dentition.

The specimen mentioned under "Measurements", 54.5 mm. in length, presents the following state of things (Fig. 13). Each of the premaxillaries has, rather close to the point of the snout, five sligthly curved, fairly large teeth placed close together, the foremost are the smallest (0.1 mm.) the hindmost the largest (0.3 mm.), then nine small teeth, curved with the points turned backwards, and from about the middle of the premaxillaries ten saw-tooth-like teeth which with their long bases crowd up to each other (0.75 mm.). On the palatines there are, in front, three fairly large teeth (0.3—0.4 mm.) followed by fourteen smaller ones. The lower jaw has, in front, three curved teeth (0.1, 0.4 and 0.5 mm.); after some small teeth follow six fairly large straight and erect ones (abt. 0.4 mm.) of which the hindmost is further forward than the corresponding one in other species; among these, though situated more exteriorly than the larger ones, are some small teeth. The posterior half of the dentary is furnished with only a few small teeth. The average length of the larger teeth in the lower jaw amounts to 4.9 % of the length of the snout.

The specimen, 83 mm. in length, taken by the "Albatross", described and figured by GOODE and BEAN as *P. coregonoides*, presents a similar dentition to that described above as regards the lower jaw and the palatines, while the furnishing of the premaxillaries differs in the number of the small backward curved teeth being increased to sixteen in each and in the presence of the same characteristic arrangement in pairs as is found in the type-specimen; behind them sixteen saw-tooth-like teeth are placed. The dentition in this specimen thus forms a good connecting link between the very different conditions in the two preceding ones.

Numerical values. The six specimens dealt with under "Measurements" show the following figures, the numerals refer to the same specimens as in that section. ZUGMAYER has found 10 rays in the dorsal fin of the type-specimen, strangely enough, he has included the hindmost ray — which in the dorsal and the anal fin within this genus is close up to the hindmost but one — in the anal fin but not in the dorsal fin.

	D.	A.	P.	V.	C.	R.br.	Vert.
No. 1.	11	23	17	9	10?/19/11	8	66
» 2.	11	23	17	9	..	8	65
» 3.	12	23	17	9	..	8	67
» 4.	..	..	16	..	..	..	66
» 5.	11	23	16	9	..	..	66
» 6.	11	23	16	9	16/19/15	..	..

In the specimen from Breiðavik mentioned by Sæmundsson (1927) I have, like this author, found 65 vertebræ. For the rest we have the following figures:—

Station No.	Tot. ex. C. mm.	D.	A.	P.	V.	C.	R.br.	Vert.
1152	34	11	..	15	..	..	..	67
»	29	11	23	16	..	..	..	66
1156	45	11	23	16	9	15/19/14	8	..
»	28	11	22	..	..	..	..	66
1157	27	..	23	..	..	..	..	66
»	19	..	..	..	..	..	..	65
»	38	11	22	16	9	17/20/?	..	65
»	24	11	..	..	..	..	..	65
1185	38	..	23	16	..	..	..	64
1189	28	..	..	..	..	..	..	64

The average number of rays, in the anal fin, 22.8, is about 1 less than in *P. speciosus*; but otherwise no difference, as regards the fins, can with certainty be pointed out. The best numerical character is found, as a rule in cases where the numerical values of two species are very nearly alike, in the number of vertebræ. The figures of vertebræ in *P. brevis* give the following graph:—

67 o o
66 o o o o o o o
65 o o o o o
64 o o

The average value of the 15 figures is = 65.5. In *P. speciosus* the average value found is = 68.9, and only one variate has been found common to the two species, namely 67.

As *P. brevis* has previously been confused with the two forms of *P. coregonoides* it may be of interest to draw a comparison with regard to the characters which, besides those mentioned in the general synopsis, present the greatest differences. The values below are all derived from adult specimens:—

	P. coreg. boreal.	*P. coreg. coreg.*	*P. brevis*
Length of head in % of total length excl. caudal.....	22.4—24.4	24.3—25.7	25.3—26.1
Length of snout in % of » » » »	10.3—11.1	11.1—11.8	12.3—13.1
Height of body in % of » » » »	10.3—11.5	10.4—10.7	11.6—13.1
Average height of scales of lateral line to height of body as	abt. 1 to 10	abt. 1 to 10	abt. 1 to 6
D.	10 (—11)	11	11 (—12)
A.	24—25	24	22—23
P.	14—15	15—16	16—17
Vert.	72—74	70	64—67

The adolescent specimen, 84 mm. long, mentioned and figured under *P. coregonoides* by ROULE and ANGEL (1930, p. 66, pl. III, fig. 83 and 84) is stated to have a length of head contained $3^1/_3$ times in the total length excl. caudal fin. To judge by the drawing it appears to be at the same stage of development as the previously mentioned specimen of *P. brevis*, of about the same length, taken by the "Albatross", in which the length of the head is contained $3^3/_5$ times in the total length. The specimen mentioned by these authors may therefore without doubt be referred to *P. brevis*.

Possibly ZUGMAYER'S specimen is identical with KRØYER'S *P. atlanticus*, described on the basis of a specimen stranded at the Skaw in 1865. As, however, both the specimen and the original description, which existed only in manuscript, have been lost, one is reduced exclusively to the extracts made from it by LÜTKEN, which, however good they may be, still do not give sufficiently exhaustive information to admit of the matter being settled, particularly as actual discrepancies are present. The numerical values are a little different to those found in the specimens of *P. brevis*, namely P. 15, A. 20 in KRØYER'S specimen and those given above in *P. brevis*. The description of the scales of the lateral line agrees with what we find in *P. brevis* in the respect that they consist of a fairly narrow anterior and a broader posterior part, whereas not with regard to the number of openings, as KRØYER finds that they have only a single one, while those in the specimens of *P. brevis* examined by me (incl. thê type-specimen) have two openings though their distance from each other is comparatively small, say, about half as great as in *P. coregonoides borealis*, in proportion to the height of the body. No information is given as to the height of the scales of the lateral line. The length of the head in KRØYER'S specimen is contained 4.6 times, that in the examined adult specimens of *P. brevis* nearly 4 times, in the total length excl. caudal fin. If these proportional figures can be contained within the same species, one must assume a somewhat wider range of variation in *P. brevis* than is found in other species.

The young specimen, 64 mm. in length, described by PARR (1928, p. 36) as a new species, *Sudis bronsoni*, is doubtless to be referred to *P. brevis*. Certain divergent details, such as the smaller number of rays in the anal fin, 20, and the somewhat longer predorsal length (calculated at 64.1%, according to the drawing at 60.8%, of the total length excl. caudal fin), must be due to a not overcareful examination. The pigmentation, as the drawing shows, agrees exactly with that in the larger specimens in my material as shown in Fig. 14, 8 in a specimen 54.5 mm. long. Particular attention is directed to the small number of pigment sections in the peritoneum, the long mediolateral row of fairly large chromatophores and the few fairly large chromatophores at the base of the foremost and hindmost rays of the anal fin. The particularly thin scales mentioned by PARR, I find again in the little larger specimen taken by the "Albatross", 83 mm. in length, while they are as yet undeveloped in the largest specimens in the collection of the "Dana".

Postlarval development. In the foregoing, several points of similarity between *P. speciosus* and *P. brevis* are pointed out, thus, as regards proportions, certain particulars of dentition (the same relative length of the larger teeth in the lower jaw and the presence of several fairly large teeth in the foremost part of the premaxillaries) and numerical values. A similar agreement holds good of the postlarval development in respect of the circumstance that this has been run through and the adolescent stage reached in individuals of a comparatively small size, say, about half that of the corresponding one in *P. coregonoides*. But the pigmentation is quite different, and certain dimensions, particularly the length of the head, are rather divergent at several stages of the two species.

As stated during the description of the postlarval development in *P. speciosus*, I have examined two specimens of the eight postlarvæ which ZUGMAYER describes under the name "*Omosudis elongatus*". The two specimens proved to be very different from each other, the one taken in the Mediterranean to be *P. speciosus*, while that from St. 1800 (1904) to have the characteristic chromatophores and proportions of measurement of *P. brevis*. ROULE and ANGEL (1930, p. 63 and 64, pl. III, fig. 81 and 82) have under *P. coregonoides* described and figured two postlarval specimens, 13 and 17.8 mm. long. Both the figures,

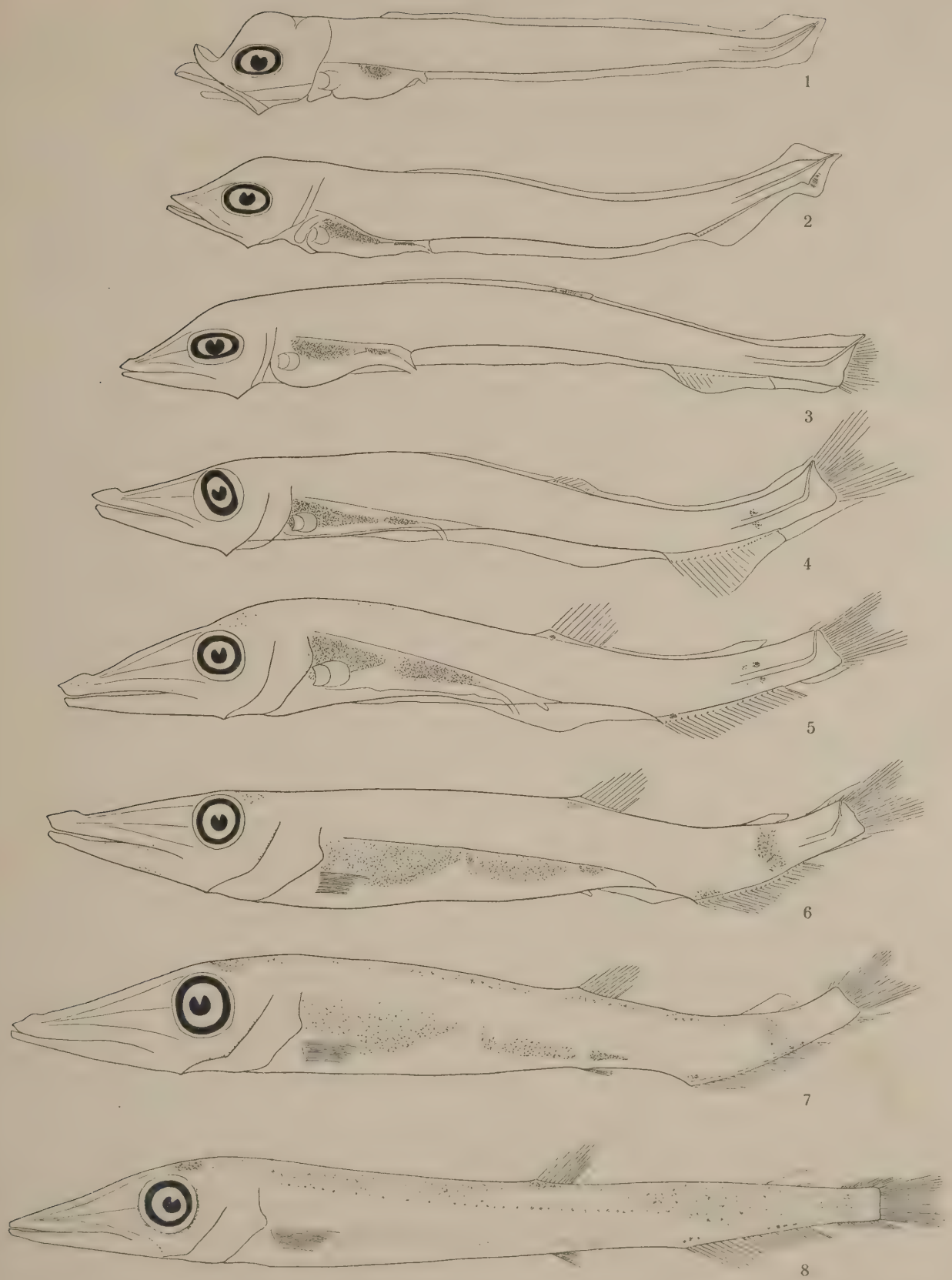


Fig. 14. *Paralepis brevis* Zugmayer. Postlarval stages, length ex. C. 1: 5.8 mm. (St. 1322), 2: 8.2 mm. (St. 1328), 3: 9.8 mm. (St. 1328), 4: 11.7 mm. (St. 1329), 5: 14.3 mm. (St. 1356), 6: 19.3 mm. (St. 1157) and adolescent stages, 7: 28.0 mm. (St. 1152) and 8: 54.5 mm. (St. 1156).

however, show the great length of head and snout and also the peculiar pigmentation which, doubtless, refer the specimens to *P. brevis*.

The material which forms the basis of this investigation includes several different sizes of postlarvæ of this species which can substantially illustrate the development, as it will be described in the following.

The synopsis below shows the preanal length and the length of the snout in the figured specimens:—

Total length excl. caudal (mm.)	5.8	8.2	9.8	11.7	14.3	19.3	28.0	54.5
Preanal length in % of total length	abt. 38	35.4	38.8	46.2	60.1	67.9	68.2	65.3
Length of snout in % of total length	abt. 6	7.3	9.7	13.7	17.5	18.7	20.0	14.9

Characteristic is the high value which the length of the snout reaches in the older postlarval and in the young adolescent specimens (28.0 mm.). The preanal length has already its final value in specimens which are only 19.5 mm. in length.

Fig. 14, 1 shows a specimen *5.8 mm.* in length. The end of the notochord is straight, there is no indication of hypurals. The jaws are bent upward, the eye is oval. The pectoral fins are indicated, otherwise no trace of fins is to be seen. The foremost peritoneal pigment section is present.

8.2 mm. (Fig. 14, 2). The larger hypurals are indicated. The jaws are protruding, the eye oval. The caudal fin is indicated, of the anal fin a faint indication of the foremost interspinous rays is to be seen. The foremost peritoneal pigment section is perceptibly larger than in the preceding specimen, behind is to be seen the beginning of the second, at present as a short, broad streak.

9.8 mm. (Fig. 14, 3). The end of the notochord is bent upward, all hypurals are indicated, the posterior edge of the hypurals is about vertical to the longitudinal axis of the animal. The rays of the caudal fin can be distinguished singly, in the anal fin about half of the interspinous rays and a few rays; the dorsal fin is faintly indicated appearing only as a density in the embryonic fin.

11.7 mm. (Fig. 14, 4). In the anal fin about half the rays can be distinguished, in the dorsal fin several interspinous rays and a few rays. There are two peritoneal pigment sections present, the second is still by far the smaller. Besides, on the side of the tail, about midway between the commencement of the anal fin and the posterior edge of the hypurals there are two chromatophores, one above and one below the notochord, situated superficially.

14.3 mm. (Fig. 14, 5). The eye is only slightly oval. The embryonic fin is, dorsally, greatly reduced, can be seen distinctly only behind the dorsal fin, the extension and shape of the adipose fin being, besides, approximately shown; on the ventral side the embryonic fin commences at the anus but is not yet perceptibly reduced between the anus and the anal fin. Individual rays of the anal and the dorsal fin can now be distinguished, the ventral fins are indicated. The second peritoneal pigment section is about of the same size as the foremost, but differs from it in shape, being longer and narrower. The stellate chromatophores which, at the preceding stage, appear above the hindmost part of the anal fin, are doubled and, in addition to this, a prominent chromatophore of a similar kind has developed at the base of the foremost rays of the anal fin and two at the base of the foremost rays of the dorsal fin, there are also small dot-like chromatophores along the edge of the premaxillaries and lower jaw, on the snout, above the brain and on the foremost part of the back.

19.3 mm. (Fig. 14, 6). The eye is round. The rays of the dorsal and the anal fin can be counted, the pectoral fins are developed and approach in appearance what is found at the adolescent stage. There are three peritoneal pigment sections. In about the same place where, at the preceding stage, the dorso- and ventrolateral chromatophores are situated, there is now to be seen a diffused pigment-belt, covering four myomeres from the dorsal to the ventral median line; a fairly large patch of pigment is to be seen at the

base of the front part of the dorsal and the anal fin, occupying about the same position as the large chromatophores mentioned above.

In connection with the description of the postlarval stages, two stages must be mentioned which must, *inter alia* in consequence of the development of the secondary pigment along the whole of the dorsal side and the forming of the ventral fins and the adipose fin, be designated as adolescent.

28.0 mm. (Fig. 14, 7). The embryonic fin has disappeared, and the adipose fin has approximately assumed its final form and extent of base. Most of the small rays in the caudal fin are present, the rays in the anal fin formed. There are three peritoneal pigment sections, the hindmost is far smaller than the others. The belt of pigment on the side of the tail, mentioned at the preceding stage, still stands out between the belly and the mediolateral line of the tail but dorsally merges into the pigment that has developed along the entire dorsal side of the trunk and tail. The pigment at the base of the foremost part of the anal fin is still distinctly to been seen. Besides this, two fairly large single chromatophores have developed at the base of the hindmost rays of the anal fin. The head is pigmented between and behind the eyes, on the point of the snout, along the edge of the jaws and also on the posterior edge of the præoperculum.

54.5 mm. (Fig. 14, 8). The peritoneal pigment sections show but indistinctly on the outer side of the body, but the number does not seem to have increased. The dorsal pigment is denser than at the preceding stage, and is continued on the sides to about the mediolateral line which is marked by a row of fairly large chromatophores, these partly disappear in the tail which, from about the origin of the anal fin, is pigmented below the mediolateral line as well. Along the base of the two hindmost fifths of the anal fin is a row of five fairly large chromatophores, two of them as in the preceding and three in front of these. At the base of the front part of the anal fin there are three chromatophores somewhat smaller than those just mentioned.

5. PARALEPIS SPHYRÆNOIDES Risso.

Paralepis sphyrænoides, Risso, 1826, p. 473, pl. 7, fig. 16.
Paralepis sphyrænoides, Cuvier and Valenciennes, 1828—49, vol. III, p. 360.
Paralepis sphyrænoides, Canestrini, 1871—72, p. 127.
Paralepis sphyrænoides, Bellotti, 1877, p. 54 and 57.
Paralepis sphyrænoides, Moreau, 1881, vol. III, p. 521.
Paralepis sphyrænoides, Carus, 1889—93, p. 567.
Paralepis sphyrænoides, Bellotti, 1891, p. 138 and 1892, p. 16.
Paralepis sphyrænoides, Lütken, 1892, p. 225.
Paralepis speciosus?, Pietschmann, 1914, p. 445, Taf. V, Fig. 1.
Paralepis spec., Pietschmann, 1914, p. 447, Taf. V, Fig. 3.
Paralepis sphyrænoides, Ege, 1918, p. 244.
Paralepis sphyrænoides, Sanzo, 1918, p. 450 (partim).
Sudis sphyrænoides, Parr, 1928, p. 36.

Measurements. Risso does not mention any measurements in his original description of the species; but according to the accompanying illustration the length of the head is contained 4.9 times in the total length excl. caudal fin, the height of the body about 14.9 times in the same length and the ventral fins are inserted in front of the dorsal fin at a distance that is about equal to the height of the body. Cuv. and Val. have not themselves examined any specimen, they speak only of Risso's description and illustration. Moreau states that the length of the head is contained $5^1/_4$—$5^3/_4$ times, the height of the body 12—14 times in the total length. Bellotti finds that the length of the head is contained 5 times in

the total length without the caudal fin, and that the ventral fins are inserted in front of the dorsal fin at a distance equal to that from the front margin of the eye to the posterior edge of the præoperculum.

The material of the Danish expeditions contains only younger specimens which, in respect of measurements, cannot in advance be considered well adapted to direct comparison with the statements of previous authors; but I have examined two fairly large specimens in the collection of British Museum and in them found the proportion between the length of the head and the total length excl. caudal fin to be 1 to 5.36 and 1 to 5.6. In the following are given the different measurements in the two specimens, in an adolescent and in two postlarval specimens. The measurements are also expressed in percentages of the total length excl. caudal fin. The numerals refer to the following informations:—

No. 1 — British Museum, 85.6.22.155 — Messina — Florence Zool. Mus.
» 2 — British Museum, 88.11.29.62 — Milano Nat. Hist. Mus.
» 3 — "Dana", St. 1107, 1921, 300 m.w.
» 4 — "Thor", St. 57, 1909, 25 m.w.
» 5 — "Dana", St. 1119, 1921, 300 m.w.

	mm.				
	1.	2.	3.	4.	5.
Total length	174	153	64	44	27
Total length excl. caudal fin	168	150	60.0	42.5	26.3
Predorsal length	99.5	89	34.9	24.8	15.6
Preventral length	90	80	31.2	22.1	14.0
Preanal length	102	89	35.3	25.0	15.7
Length to origin of anal fin	132	116	46.7	33.5	20.8
Length of head	30	28	10.1	5.6	3.4
Length of snout	13.2	13.0	4.6	2.1	1.1
Diameter of eye	6.2	6.2	2.0	1.2	0.9
Length of dorsal fin at base	..	6.5	2.4	1.3	..
Length of anal fin at base	..	24.0	10.0	6.8	4.3
Distance from anal fin to caudal fin	..	..	0.8	..	..
Distance from anal fin to end of vertebral column	..	8.3	3.1	2.3	1.3
Distance from adipose fin to caudal fin	..	..	1.0	..	..
Distance from adipose fin to end of vertebral column	..	8.6	3.3	..	..
Height at insertion of pectoral fins = greatest height of body	10.1	9.5	3.5	2.0	1.3
Height at insertion of ventral fins	9.2	8.3	3.5	2.0	1.3
Height at foremost ray of anal fin	8.4	7.5	2.9	1.7	1.1
Height at hindmost ray of anal fin	..	4.0	1.7	1.1	0.7

	% of Tot. ex. C.				
	1.	2.	3.	4.	5.
Predorsal length	59.2	59.3	58.2	58.4	59.3
Preventral length	53.6	53.3	52.0	52.0	53.2
Preanal length	60.7	59.3	58.8	58.8	59.7
Length to origin of anal fin	78.6	77.3	77.8	78.8	79.1
Length of head	17.9	18.7	16.8	13.2	12.9
Length of snout	7.9	8.7	7.7	4.9	4.2
Diameter of eye	3.7	4.1	3.3	2.8	3.4
Length of dorsal fin at base	..	4.3	4.0	3.1	..
Length of anal fin at base	..	16.0	16.7	16.0	16.3

	% of Tot. ex. C.				
	1.	2.	3.	4.	5.
Distance from anal fin to caudal fin	..	..	1.3	..	..
Distance from anal fin to end of vertebral column	..	5.3	5.2	5.4	4.9
Distance from adipose fin to caudal fin	..	..	1.7	..	..
Distance from adipose fin to end of vertebral column	..	5.7	5.5	..	..
Height at insertion of pectoral fins = greatest height of body	6.0	6.3	5.8	4.7	4.9
Height at insertion of ventral fins	5.5	5.5	5.8	4.7	4.9
Height at foremost ray in anal fin	5.0	5.0	4.8	4.0	4.2
Height at hindmost ray in anal fin	..	2.7	2.8	2.6	2.7

It can be seen how uniform the values are as regards most of the characters in individuals at such different stages of development, thus, the predorsal, preventral and preanal length and also the distance from the end of the snout to the anal fin are quite the same in the largest and in the smallest of the measured specimens. We find the greatest differences — just as in the other species — in the length of the head and the snout; whether these lengths, as is the case with those in the previously described species, reach their maximum value at a younger stage than the actual adult, I have been unable to decide for want of material. Besides the advanced position of the ventral fins and the length of the head, one notices particularly the situation of the anus below or only a little behind the origin of the dorsal fin.

Dentition. Risso, in his description of the species, mentions *inter alia* the following:— "..... les mâchoires égales; la supérieure armée d'une rangée de très petites dents aiguës, étroites, chrocues; l'inférieure garnie des grosses pointes mobiles, mêlées avec de plus petites....." Moreau finds on either side of the lower jaw a row consisting of eight to ten long conical teeth and often some smaller ones among these long teeth. Bellotti mentions that the lower jaw is furnished with long, pointed, unequal teeth placed at larger intervals from one another.

The fairly large specimen from Messina, 168 mm. in length, presents the following dentition. The premaxillaries are occupied by many small, closely packed, curved teeth with points turned backwards, the palatines have a few rather long curved teeth. In the lower jaw there are, on either side, six long, slender, straight, erect teeth (average length 1.3 mm.), close up to each of these are two smaller teeth (0.7 mm.). The average length of the large teeth in the lower jaw amounts to 9.8 % of the length of the snout.

In the adolescent specimen, 60 mm. in length, to which reference has been made, the dentition is as follows (Fig. 15). The premaxillaries have each twelve rather short, curved teeth with about the same distance from each other, in the foremost the points are directed backwards, in the hindmost, forwards (abt. 0.1 mm.). On each palatine, to the front, there are two straight teeth (0.15 mm.) followed by five curved ones (0.5 mm.). In the lower jaw there are, just as in the larger specimen, a few fairly large teeth, on either side, in this case five (abt. 0.3 mm.); there is a greater interval between the two foremost than between the rest, this interval is partly filled by three short teeth (abt. 0.1 mm.), beside a couple of the long teeth there is a single shorter one; but the regular grouping of two small teeth beside each of the larger ones is not yet found. The average length of the larger teeth in the lower jaw amounts to 6.5 % of the length of the snout, a somewhat less value than that found in the larger specimen.

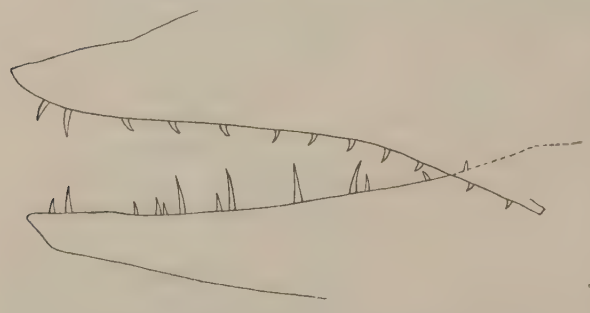


Fig. 15. *Paralepis sphyrænoides* Risso. Length ex. C. 60 mm. (St. 1107). Premaxillary and mandibular dentition.

Numerical values. Risso mentions the following numbers of rays:—

D. 10, P. 10, V. 9, A. 30, C. 18, R.Br. 7.

Moreau gives this formula:—

D. 10 — 3 à 6; A. 28 à 30; C. 8/16 à 18/7; P. 12—13; V. 8—9.

Bellotti states:—

D. 10 + 3—6, A. 30.

The two fairly large specimens examined by me give the following numbers of rays and vertebræ: —

	D.	A.	P.	V.	Vert.
No. 1.	?	?	11	9	92
» 2.	11	31	11 (and 12)	8	91

In postlarval (and adolescent) specimens from the Mediterranean the following numbers of rays have been found:—

	Tot. ex. C. mm.	D.	A.	P.	V.	C.	R.br.
Messina, 1912	78	11	31	11	9	. .	. .
» »	55	11	31	11	9	. .	7 (and 8)
St. 57	53	11	32	11	9	x/19/x	7
» »	48	11	31	11	. .	x/18/x	. .
» 59	43	11	30	11	. .	x/19/x	. .
» 1119	39	11	30	11	9	. .	7
» 1131	45	11	30	11	9	x/19/x	7
» »	36	11	30	11	9	x/19/x	7

It has been possible to count the rays in the anal and the dorsal fin in the smaller specimens as well. The dorsal fin has invariably given the number 11. The anal fin gives, including the figures entered above, the following graph:—

32 o o o
31 o o o o o o o o o o o o o o o o o o o o o o o
30 o o o o o o o o o

The average value of the 34 figures is = 30.74. The examination of the material from the Mediterranean with regard to the number of vertebræ has given the result below:—

Station No.	No. of vertebræ
26	90
28	90, 90
29	90
39	91, 91
43	90, 91, 91
45	89, 90, 91
46	90
55	89, 90
57	89, 90, 90, 90
106	89, 90, 90, 90, 91
112	91

Station No.	No. of vertebræ
115	89, 90, 90, 90, 91
182	90, 91
223	89, 90, 90, 91
224	90, 90, 90, 91, 91
225	91, 91
1119	89, 89, 90, 90, 90, 90, 90, 91, 91, 91, 92, 92
1122	91
1123	90
1126	90, 90, 90, 90, 91, 91
1131	88, 90

The figures give the following graph:—

92 o o
91 o o o o o o o o o o o o o o o o o o o o o
90 o o o o o o o o o o o o o o o o o o o

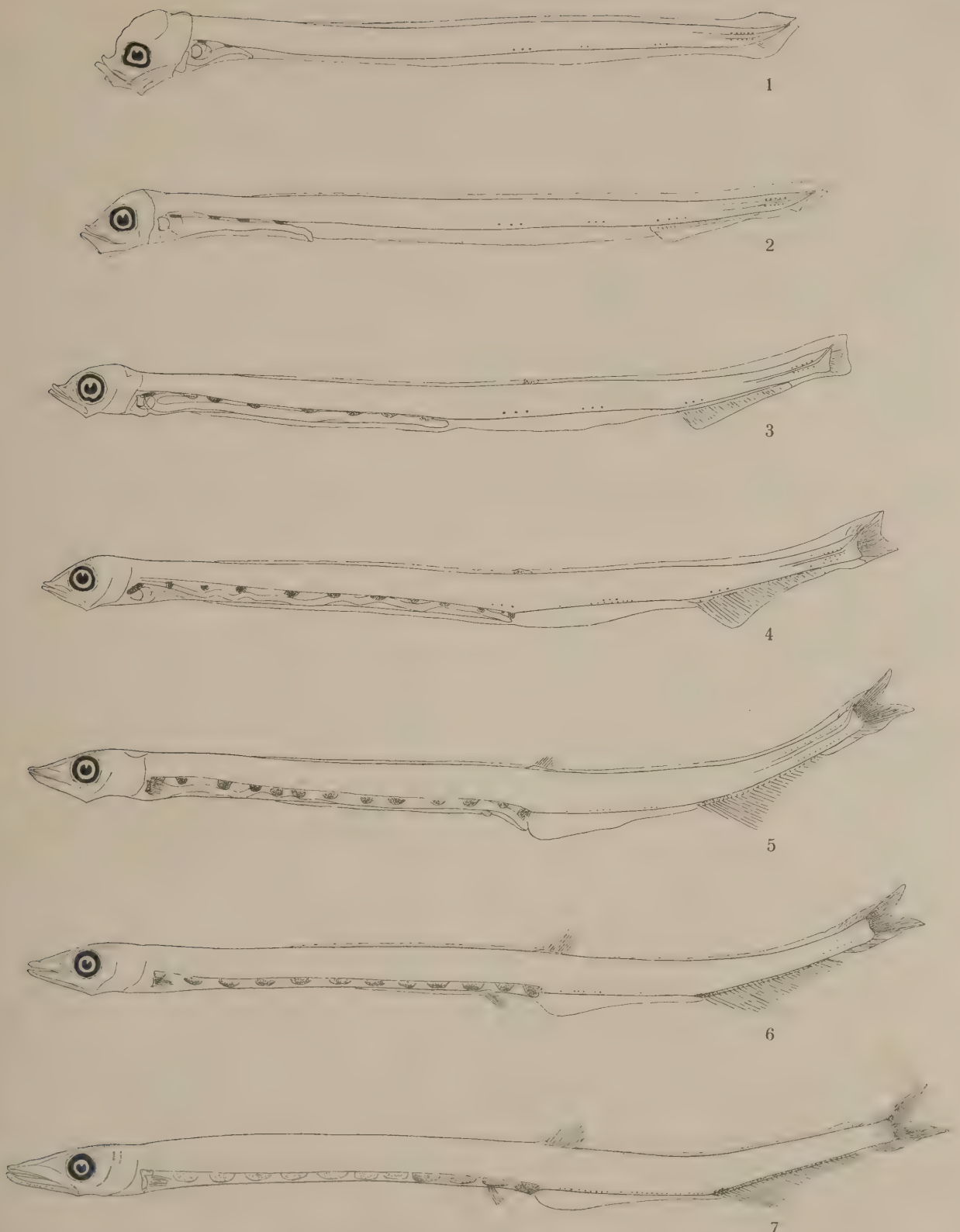


Fig. 16. *Paralepis sphyrænoides* Risso. Postlarval stages, length ex. C. 1: 7.5 mm. (St. 46, 1909), 2: 15 mm. (St. 46, 1909), 3: 19 mm. (St. 46, 1909), 4: 21.5 mm. (St. 46, 1909), 5: 27 mm. (St. 224, 1910), 6: 41 mm. (St. 224, 1910) and 7: 55 mm. (Messina, 1911).

It will be seen, that the preanal length, in contrast to that in the species previously described, has already reached the approximately final value at a stage where the length of the snout has, as yet, increased only slightly.

Fig. 16, 1 shows a specimen *7.5 mm.* in length. The very elongated body is surrounded by the embryonic fin except to the front dorsally. The end of the notochord is bent slightly upward, but there are no indications of hypurals to be seen. The head is about as high as it is long. The pectoral fins are present, but quite small and undeveloped, furthermore, a small indication of the caudal fin is visible. There are two peritoneal pigment sections. About midway between the anus and the end of the tail there is a group of three large chromatophores, situated ventrally, midway between this and the end of the tail a similar group, and near the end of the tail two short laterally situated rows, one below and one above the notochord, each consisting of five or six chromatophores, finally, between the two ventral groups there is a fourth group which, at this stage, is less prominent than the others.

15 mm. (Fig. 16, 2). The head is more elongated than at the preceding stage. The anal fin is indicated, about the foremost half of the interspinous rays can be distinguished. There are four peritoneal pigment sections. The middlemost of the three ventral groups of chromatophores is more prominent than at the preceding stage.

19 mm. (Fig. 16, 3). Most of the hypurals are distinctly to be seen, and the end of the notochord is bent still more upward. In the caudal fin most of the long rays can be distinguished, in the anal fin most of the interspinous rays and about half of the rays, the dorsal fin is faintly indicated. There are eight peritoneal pigment sections.

21.5 mm. (Fig. 16, 4). The posterior margin of the hypurals stands vertically to the longitudinal axis of the body. The intestine has almost reached its final relative length, the anus lies below the origin of the dorsal fin. Most of the rays of the anal fin can be distinguished, the dorsal fin stands out a little more distinctly than at the preceding stage. There are twelve peritoneal pigment sections, the hindmost are still small. The three ventral groups of chromatophores and the lateral group, situated near the end of the tail, are still plainly to be seen; but the beginning of the secondary pigment is also to be seen in the form of two rows of dot-like chromatophores in the hindmost part of the tail, of these one is situated just above and one just below the primary lateral group of chromatophores, and a row of similar tiny chromatophores stretches along the ventral median line on the middlemost half of the part between the anus and anal fin and lying immediately below the middlemost of the three primary ventral groups of chromatophores. The head is faintly pigmented.

27 mm. (Fig. 16, 5). The small rays of the caudal fin are partially developed, most of the rays in the dorsal fin are present and the ventral fins have come in sight. This specimen has thirteen peritoneal pigment sections, which number, however, does not signify a further development, in that respect, from the preceding stage, but merely an individual variation as, in the older stages, one also finds twelve as the generally occurring number. The primary pigment, in the form of the four groups of chromatophores, has now disappeared, while the secondary pigment mentioned at the foregoing stage is further developed; the length of the two lateral chromatophores in the hindmost part of the tail being doubled, and the ventral row between the anus and the anal fin is increased on both sides.

41 mm. (Fig. 16, 6). The rays in the dorsal and the anal fin can be counted, the rays in the pectoral fins have become longer and the ventral fins are formed. There are twelve peritoneal pigment sections, the hindmost part of the last one extends below the foremost rays of the dorsal fin, ten of them in front of the ventral fins; the individual sections have increased in size so that the intervals between them are less than their measure of length, while the reverse is the case at the stages previously described. The two lateral rows of chromatophores in the hindmost part of the tail are less prominent, while the head is more strongly pigmented above the brain and on the lower jaw than at the preceding stage.

55 mm. (Fig. 16, 7). The embryonic fin is greatly reduced, dorsally it begins behind the dorsal fin and is only present as a low border, the adipose fin is clearly defined; ventrally it is to be found only between the anus and anal fin. As regards the pigment, the twelve peritoneum sections are considerably larger and the intervals between these are narrower than at the preceding stage, with the exception of the hindmost they are less distinctly to be seen from without, owing to the greater thickness of the wall of the abdominal cavity. The ventral row of small chromatophores between the anus and anal fin stretches along almost the whole of this portion, consisting of 30 ones, whereas the two lateral rows in the hindmost part of the tail have disappeared from the surface. A diffused pigment has developed along the back edge of the tail and at the base of the front rays of the anal fin, furthermore, there is a row of dots along the dorsal median line behind the dorsal fin. The pigment which at the younger stages occurs above the brain and on the lower jaw has increased in extent and the end of the snout is pigmented.

In connection with the description of the postlarval development, some numbers found of peritoneal pigment sections in larger postlarval specimens must be stated, namely 13 sections in three, 12 in eight and 11 in two specimens.

6. PARALEPIS PSEUDOSPHYRÆNOIDES Ege.

Paralepis pseudosphyrœnoides, Ege, 1918, p. 244.
Paralepis sphyrœnoides, Sanzo, 1918, p. 450 (partim), fig. 2.
Paralepis pseudosphyrœnoides, Parr, 1928, p. 36.
Paralepis sphyrœnoides (sensu lat.), Roule and Angel, 1930, p. 67 (partim), pl. III, fig. 85.

In my preliminary note (January 1918) on the postlarval stages of the species of *Paralepis* found in the Mediterranean and the north-eastern part of the Atlantic, I have given the more important characters in respect of which this species differs from Risso's old species *P. sphyrœnoides*, namely the number of vertebræ (and rays in the anal fin), certain measurements and the postlarval pigmentation. Sanzo, in his previously mentioned note on *P. sphyrœnoides* (June 1918), has also made this form the object of a short report though not with the statement of any new specific name. He names as specifications from *P. sphyrœnoides* 82—84 segments instead of 92—94 which should be the final number of vertebræ in *P. sphyrœnoides*, furthermore, that it has larger eyes and a longer snout and also that it represents a more developed stage than a specimen of *P. sphyrœnoides* of the same size. Though he thus acknowledges these fairly essential differences he concludes with the following astounding remark (l. c. p. 454):— ". . . . . Se tali larve debbano ritenersi specificamente diverse dalle prime, ovvero rappresentino un sesso della stessa specie *P. sphyrœnoides*, sarà discusso nel lavoro monografico."

Roule and Angel (1930, p. 68, pl. III, fig. 85) have under *P. sphyrœnoides* described and figured an adolescent (or a fairly old postlarval) specimen, 49 mm. long. The length of the head, which is stated to be contained only $4^2/_3$ times in the total length excl. caudal fin, shows, as will appear from the following, that the specimen must be referred to *P. pseudosphyrœnoides*.

Measurements. In the following is a statement of the different measurements in the largest known specimen of the species, an adolescent individual 92 mm. in length, and also in three postlarval specimens; the measurements are also expressed in percentages of the total length excl. caudal fin. The numerals refer to the following informations;—

No. 1. — R/S "Dana", St. 1110, 1921, 300 m. w.
» 2. — M/S "Dana", St. 882, 1920, 150 —
» 3. — » » St. 861, 1920, 100 —
» 4. — » » St. 880, 1920, 100 —

	mm.				% of Tot. ex. C.			
	1.	2.	3.	4.	1.	2.	3.	4.
Total length	95.5	52.5	43.0	26.5				
Total length excl. caudal fin	92	50.0	40.5	25.4				
Predorsal length	53.9	29.1	23.2	15.2	58.6	58.2	57.3	59.8
Preventral length	48.0	26.1	20.8	13.3	52.2	52.2	51.4	52.4
Preanal length	53.5	29.6	23.7	15.3	58.2	59.2	58.5	60.2
Length to origin of anal fin	71.5	39.0	31.6	20.3	77.7	78.0	78.0	79.9
Length of head	19.5	9.2	7.1	4.4	21.2	18.4	17.5	17.3
Length of snout	9.5	4.2	3.0	1.7	10.3	8.4	7.4	6.7
Diameter of eye	4.0	2.0	1.7	1.0	4.3	4.0	4.2	3.9
Length of dorsal fin at base	3.8	2.1	1.8	1.0	4.1	4.2	4.4	3.9
Length of anal fin at base	14.8	8.5	6.5	4.0	16.1	17.0	16.0	15.7
Distance from anal fin to caudal fin	2.1	0.7	..	..	2.3	1.4	..	..
Distance from anal fin to end of vertebral column	5.3	2.6	2.4	1.2	5.8	5.2	5.9	4.7
Distance from adipose fin to caudal fin	2.1	0.5	..	..	2.3	1.0	..	..
Distance from adipose fin to end of vertebral column	5.3	2.7	..	..	5.8	5.4	..	..
Greatest height of body	7.4	3.5	2.6	1.7	8.0	7.0	6.4	6.7
Height at insertion of pectoral fins	7.0	3.5	2.6	1.7	7.6	7.0	6.4	6.7
Height at insertion of ventral fins	5.9	3.1	2.4	1.4	6.4	6.2	5.9	5.5
Height at foremost ray of anal fin	5.2	2.7	1.9	1.2	5.7	5.4	4.7	4.7
Height at hindmost ray of anal fin	2.8	1.4	1.1	0.8	3.0	2.8	2.7	3.1

To illustrate the relation between *P. sphyrænoides* and *P. pseudosphyrænoides*, the three postlarval specimens are compared below with specimens of *P. sphyrænoides* of approximately the same size, while the large specimen, in the absence of a specimen of the same size, is compared with a larger and a smaller specimen of *P. sphyrænoides*. The measurements are expressed in percentages of the total length excl. caudal fin. No. 1—4 refer to the four specimens of *P. pseudosphyrænoides*, the Roman figures to specimens of *P. sphyrænoides*, namely:—

No. I. — "Dana", St. 1107, 1921, 300 m. w.
» Ia. — Brit. Mus. — Milano Nat. Hist. Mus.
» II. — "Thor", St. 57, 1909, 25 m. w.
» III. — » St. 57, 1909, 25 —
» IV. — "Dana", St. 1119, 1921, 300 m. w.

	1.	I.	Ia.	2.	II.	3.	III.	4.	IV.
Total length	95.5	64	153	52.5	56.5	43.0	42	26.5	27
Total length excl. caudal fin	92	60	150	50	54	40.5	40.7	25.4	26.3
Predorsal length	58.6	58.2	59.3	58.2	58.9	57.3	57.7	59.8	59.3
Preventral length	52.2	52.0	53.3	52.2	52.2	51.4	51.6	52.4	53.2
Preanal length	58.2	58.8	59.3	59.2	59.3	58.5	58.2	60.2	59.7
Length to origin of anal fin	77.7	77.8	77.3	78.0	78.7	78.0	78.1	79.9	79.1
Length of head	21.2	16.8	18.7	18.4	14.4	17.5	13.3	17.3	12.9

	1.	I.	I a.	2.	II.	3.	III.	4.	IV.
Length of snout	10.3	7.7	8.7	8.4	6.9	7.4	5.2	6.7	4.2
Diameter of eye	4.3	3.3	4.1	4.0	3.1	4.2	2.9	3.9	3.4
Length of dorsal fin at base	4.1	4.0	4.3	4.2	2.8	4.4	2.9	3.9	..
Length of anal fin at base	16.1	16.7	16.0	17.0	16.7	16.0	16.7	15.7	16.3
Distance from anal fin to end of vertebral column	5.8	5.2	5.3	5.2	5.2	5.9	5.4	4.7	4.9
Distance from adipose fin to end of vertebral column	5.8	5.5	5.7	5.4	5.7	..	..	..	..
Height at insertion of pectoral fins	7.6	5.8	6.3	7.0	5.4	6.4	4.7	6.7	4.9
Height at insertion of ventral fins	6.4	5.8	5.5	6.2	4.6	5.9	4.4	5.5	4.9
Height at foremost ray in anal fin	5.7	4.8	5.0	5.4	5.0	4.7	4.2	4.7	4.2
Height at hindmost ray in anal fin	3.0	2.8	2.7	2.8	2.6	2.7	2.5	3.1	2.7

As will be seen by a comparison between the first three specimens, the most conspicuous difference is the considerably longer head and snout in *P. pseudosphyrœnoides*; then the new species has a less slender form of body, as the height values indicate. The following arrangement in pairs of post-larval specimens of the same size shows the same differences, though more pronounced as regards the length of the head and the snout, which is due to the somewhat more advanced development in the specimens of *P. pseudosphyrœnoides*, furthermore, that the eye is larger in this species, and the length of the base of the dorsal fin is considerably greater than in a specimen, of the same length, of *P. sphyrœnoides*.

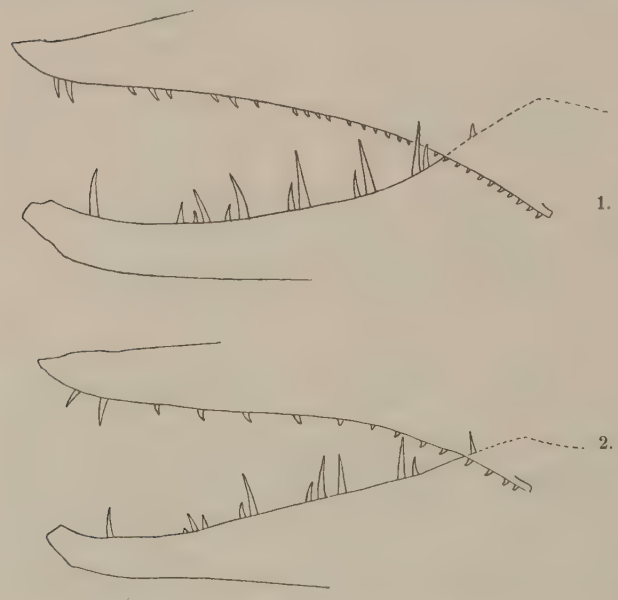


Fig. 17. *Paralepis pseudosphyrœnoides thori* Ege. Length ex. C. 1: 92 mm. (St. 1110), 2: 50 mm. (St. 882). Premaxillary and mandibular dentition.

Dentition. The adolescent specimen, 92 mm. in length, mentioned above, presents the following dentition (Fig. 17, 1). Each premaxillary has in front two comparatively large teeth (largest 0.3 mm.), after an interval follow two groups each consisting of three curved, backward inclining teeth, the middle ones being the largest (0.15 mm.); the inner half is rather closely packed with small teeth (0.05 mm.), all of them are curved, the foremost inclining backward, those in the middle are erect and the hindmost inclining forward. On each palatine there are two fairly large straight teeth (0.35 mm.) and five small curved ones. In the lower jaw to the front is a slender, erect, slightly curved tooth (0.7 mm.), after an interval follow five erect, straight, slender teeth with intervals between them of about the same length as that of the teeth (abt. 0.8 mm.); close up to each of the larger teeth is a single smaller one. The average length of the larger teeth in the lower jaw amounts to 8.4 % of the length of the snout.

In a specimen, 50 mm. in length, the dentition is as follows (Fig. 17, 2). Each premaxillary has in front two fairly large, only slightly curved teeth (0.2 mm.), is otherwise occupied by thirteen small curved teeth (abt. 0.05 mm.). On each palatine there are three fairly large teeth (0.15 mm.) and five smaller ones. The lower jaw, just as in the larger specimen, has a few fairly long, slender teeth, in all five; between the foremost and the next one to it there is a larger interval than between the rest, close

up to the long teeth is a single shorter one (0.15 mm.). The average length of the larger teeth in the lower jaw amounts to 8.3 % of the length of the snout.

A comparison between this specimen and that of *P. sphyrænoides*, 60 mm. in length, described in the foregoing, which represent about the same stage of development, results in showing that the two species differ but little from each other in respect of the dentition, the larger teeth in the lower jaw seem to be somewhat longer in *P. pseudosphyrænoides*.

With regard to certain of the characters, which will be dealt with in the following, it is possible to distinguish between two, of a surety, closely related but constantly different forms of the species. It will then be justified and, in respect of the subsequent treatment of the geographical and biological relations, practical to specify these forms as separate subspecies. As designations for the two forms I would suggest *Paralepis pseudosphyrænoides thori*, the form preliminarily described in 1918, and *Paralepis pseudosphyrænoides danæ*, subsp. n.

For the measurements and the description of the dentition only specimens of the first form have served as objects. The second form is unfortunately represented only by younger specimens in which certain characters, as for instance the dentition, are not sufficiently developed to admit of a settlement as to whether any divergences exist between the two forms in adult specimens, which, however, is not probable. As regards the measurements, for the determination of which comparative material is forthcoming, it has not been possible to point out any difference of importance.

a. PARALEPIS PSEUDOSPHYRÆNOIDES THORI Ege.

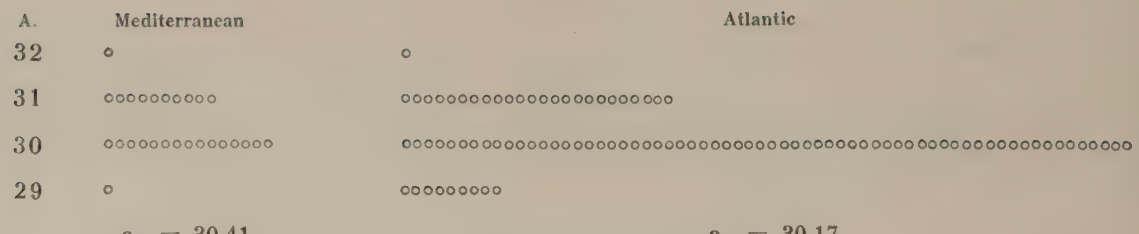
Numerical values. The fairly large specimen, 92 mm. in length, referred to, shows the following numerical values:—

D.	A.	P.	V.	C.	R.br.	Vert.
11	30	12	9	14/19/13	8	83

The following numbers of rays have been found in the larger postlarval specimens:—

Station No.	Tot. ex. C. mm.	D.	A.	P.	V.	C.	R.br.
143	39	11	30	12	9	13/19/14	8
208	37	11	31	12	9	14/19/15	8
1123	42	11	32	12		x/19/x	8
»	40	11	31	12		x/19/x	
1015	42	11	29	12	9	x/19/x	8
861	40	11	30	12	9	15/19/14	8
»	38	11	30	12	9	15/19/14	8
»	34	11	30	12		x/18/x	8
862	41	11	31	12	9		
»	38	11	29	12			7
882	35	11	30		9	x/20/x	
»	41	11	30		9	x/19/x	9
»	49	11	31	13	9	14/19/14	8
»	42	11	30	12	9		8
»	37	11	30	12	9		8

It has been possible to count the rays in the dorsal and the anal fin in the smaller specimens as well. The dorsal fin has been examined in 77 specimens, all of which have 11 rays. The numbers of rays in the anal fin, including the figures quoted above, give the following graph:—



$a_{27} = 30.41$ $a_{98} = 30.17$

The examination of the number of vertebræ in the postlarval specimens has, as regards the Mediterranean material, given the following result:—

Station No.	No. of vertebræ
143	82, 83, 83
156	82, 82, 82, 83, 83
160	84
161	82, 83, 84
194	82
199	81
200	82, 83
204	81, 82, 83, 83
206	82
208	82, 82, 83, 83, 83, 83
297	83
1122	82, 83, 83, 84
1123	82, 82, 82, 83, 83, 83, 84, 84
1126	82

Of the material from the Atlantic a great number of the larger specimens, suitable for the counting of vertebræ, are derived from the three adjacent stations 880, 881 and 882; these together have yielded 61 figures of vertebræ of which 4 specimens have given the figure 84, 25 the figure 83, 30 the figure 82 and 2 specimens the figure 81. The average value of the 61 figures is = 82.51. Besides these, other specimens from the stations mentioned below have been examined, as regards this character, with the following result:—

Station No.	No. of vertebræ
330	81, 82, 82, 83
376	82
559	82
625	83
733	83
805	81, 82
1014	82, 82
1015	82
1016	82
1020	81, 82
1021	82
1031	82, 82, 83, 83
1054	82
857	82, 83
861	82, 82, 82, 83, 83
862	82, 82, 82, 82, 82, 83, 83, 83, 83

Station No.	No. of vertebræ
876	82
877	82, 82, 82, 83, 83
878	82, 83,
879	83
883	82, 83, 83, 83
1139	82, 82, 83, 83
1141	84
1146	83, 83
1152	83
1353	82
1365	83, 83, 84
1366	82, 83, 83, 84

The entire material of figures of vertebræ gives the following graph:—

As regards the difference between this form and *P. sphyrænoides* in respect of the numerical values, the figures speak for themselves. Here, as in many other instances, the number of vertebræ is far the best of the numerical characters. *P. sphyrænoides* has about eight vertebræ more than this form and the range of variation is so small that the lowest variate found in *P. sphyrænoides*, 88, is 4 points higher than the highest found in this form of *P. pseudosphyrænoides*. The greatest difference regarding the other numerical characters is presented by the rays of the pectoral fins and the branchiostegal rays the number of which, as regards both, is about 1 greater than in *P. pseudosphyrænoides*, while the average value of the numbers of rays in the anal fin lies only about 0.5 higher in *P. sphyrænoides* than in the new species. With regard to number of rays in the dorsal fin hardly any difference exists.

Postlarval development. The following synopsis shows the preanal length and the length of the snout in the figured specimens:—

Total length excl. caudal (mm.)	8	12	15	16.5	20	25	37
Preanal length in % of total length	26.1	30.7	38.7	54.3	58.9	60.3	60.4
Length of snout in % of total length	abt. 3.8	4.0	5.2	5.0	6.5	6.6	6.8

The preanal length reaches, in this species, its final value in specimens which are a little smaller than corresponding ones of *P. sphyrænoides*; in this species the said value is reached by a specimen 20 mm. in length, in *P. sphyrænoides* it is barely reached by a specimen 21.5 mm. in length.

Fig. 18, 1 shows a specimen *8 mm.* in length. The end of the notochord is straight, the head short and high. There are two peritoneal pigment sections present. About midway between the anus and the end of the tail, a little closer to the latter, ventrally situated, is a group of three chromatophores in a row near the ventral median line, behind this, at a distance almost equal to the length of the intestine, a similar row and also towards the end of the tail a group consisting of three rows of chromatophores, two lateral,

respectively just above and just below the notochord, and a ventral along the ventral median line, each at this stage consisting of three chromatophores. By way of comparison it may be mentioned that *P. sphyrænoides* has four corresponding groups, and that the hindmost consists only of two lateral rows, the ventral is quite lacking. These differences, which have proved to be invariable, afford the most reliable means for the determination of the younger postlarval specimens. As will be mentioned later on, the hindmost group is otherwise developed in the other form of *P. pseudosphyrænoides*.

12 mm. (Fig. 18, 2). The form of the head is more elongated than at the preceding stage, a faint indication of the anal and the caudal fin is to be seen. There are four peritoneal pigment sections.

15 mm. (Fig. 18, 3). The end of the notochord is bent upwards, the hypurals indicated. The foremost interspinous rays in the anal fin can be distinguished singly. Of the chromatophores on the tail, those of the hindmost group stand out most prominently, and are distinctly stellate.

16.5 mm. (Fig. 18, 4). All the hypurals are plainly to be seen. In the anal fin about the foremost third of the rays can be distinguished. The dorsal fin is indicated, an indication of the interspinous rays is to be seen, of which those in the middle can be distinguished singly. There are ten peritoneal pigment sections. As for the rest of the pigmentation, a beginning of the secondary pigment of the tail appears in the form of a short row of small chromatophores along the ventral median line midway between the anus and the anal fin opposite the foremost of the primary postanal groups.

20 mm. (Fig. 18, 5). The anus now occupies its approximately final place below the foremost part of the dorsal fin. The interspinous rays in the anal fin can be counted, likewise the majority of the rays. In the dorsal fin eight interspinous rays can be distinguished, an indistinct indication of the ventral fins is to be seen. There are twelve peritoneal pigment sections of which the two hindmost lie behind the ventral fins. The foremost of the primary postanal groups of chromatophores is no longer to be seen, while the secondary row, lying along the ventral median line, is elongated; besides this, two rows of small chromatophores have developed, stretching parallel with the rows of the hindmost primary groups, one dorsolaterally between the dorsal median line and the upper lateral primary row, the other between the lower lateral and the ventral primary row, and also a few chromatophores ventrally, close to the back edge of the tail.

25 mm. (Fig. 18, 6). The difference between this and the preceding stage is revealed mainly by a different development of the fins. The rays in the anal fin can be counted, those in the dorsal fin distinguished, the pectoral and ventral fins are indicated, the dorsal portion of the embryonic fin is greatly reduced. The number of peritoneal pigment sections is the same as at the preceding stage; but the sections are perceptibly larger.

37 mm. (Fig. 18, 7). The embryonic fin is dorsally reduced to a low edging, only its hindmost portion is higher and denser, forming an indication of the permanent adipose fin. The twelve peritoneal pigment sections have developed particularly in a vertical direction. The row of chromatophores along the ventral median line between the anus and anal fin is elongated in both directions. The middlemost of the primary postanal groups of chromatophores is no longer to be seen, whereas there is a secondary row closer to the base of the anal fin; the three rows of the hindmost group are still to be seen, but indistinctly. The two secondary rows mentioned are elongated, particularly the ventrolateral one; besides this, a similar row along the base of the hindmost portion of the anal fin is to be seen.

In connection with the series of figures corresponding to the above descriptions of different postlarval stages, a drawing is given of the previously mentioned adolescent specimen, 92 mm. in length (Fig. 18, 8). The pigmentation is rather different to that in the oldest postlarval specimen described, though there are certain points of connection. The wall of the abdominal cavity is now so thick that the peritoneal pigment can only partially be seen from without but yet so distinctly that it still manifests itself as sections, isolated from each other, and of a similar shape to those in the postlarval specimen. The row of chromatophores between the anus and the anal fin has, likewise, almost the same appearance though the number

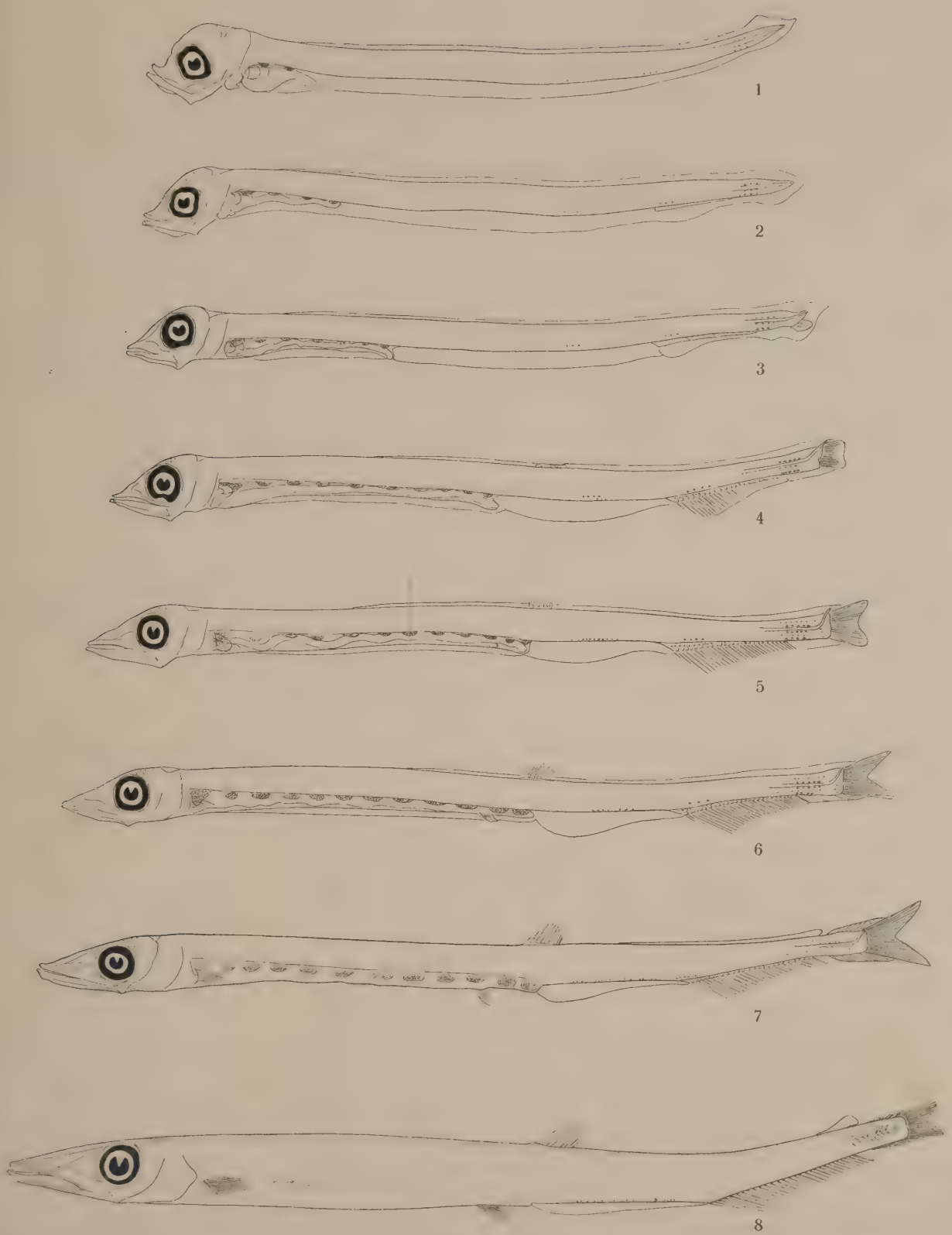


Fig. 18. *Paralepis pseudosphyrænoides thori* Ege. Postlarval stages, length ex. C. 1: 8 mm. (St. 199, 1910), 2: 12 mm. (St, 199, 1910), 3: 15 mm. (St. 199, 1910), 4: 16.5 mm. (St. 143, 1910), 5: 20 mm. (St. 143, 1910), 6: 25 mm. (St. 206, 1910), 7: 37 mm. (St. 206, 1910), and an adolescent stage, 8: 92 mm. (St. 1110).

has increased and the foremost are larger and have greater intervals between themselves than the rest. The row along the base of the anal fin is extended more to the front. The pigment which in the postlarval specimens occurs on the hindmost portion of the tail, has disappeared and, in place of it, there are in the larger specimen eight angular figures running parallel with the myomeres. The whole of the back is pigmented, above the brain there is a denser pigmentation and the anterior half of the snout is pigmented. The chromatophores along the front border of the præoperculum are large and linear.

b. PARALEPIS PSEUDOSPHYRÆNOIDES DANÆ, subsp. n.

Numerical values. The material contains only a few fairly large specimens, therefore the determination of the numerical values has been deficient except as regards the number of rays in the anal fin and the number of vertebræ. The following are the figures found:—

Station No.	Tot. ex. C. mm.	D.	A.	P.	V.	C.	R. br.
1159	28	11	31		9		
1160	32	11	31	12	9	x/19/x	8
1353	36	11	31	12		x/19/x	8
»	32	11	30	12	9		8

The aggregate result of the investigation of the number of rays in the anal fin is expressed in the following graph:—

31 o o o o o o o o o o
30 o o o o o o o o o o o o
29 o o

The average value of the 24 figures is = 30.33. In *P. pseudosphyrænoides thori* the average values found were = 30.17 and 30.41.

Below a list is given of the portion of the material found suitable for the investigation of the number of vertebræ, and the result of the same:—

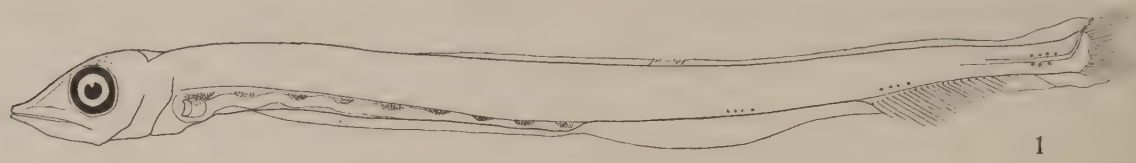
Station No.	No. of vertebræ
829	81
830	79, 79, 80
831	79, 79, 79
834	79, 80
1157	79, 79, 79, 80
1159	78, 80, 81
1160	79
1161	78, 79, 79, 80, 80, 80, 80
1341	81
1342	80, 80, 81
1345	78, 80, 80
1353	78, 80

The figures give the following graph. For the sake of comparison, the corresponding graph illustrating the result of the investigation of the Atlantic material of the other form, is repeated.

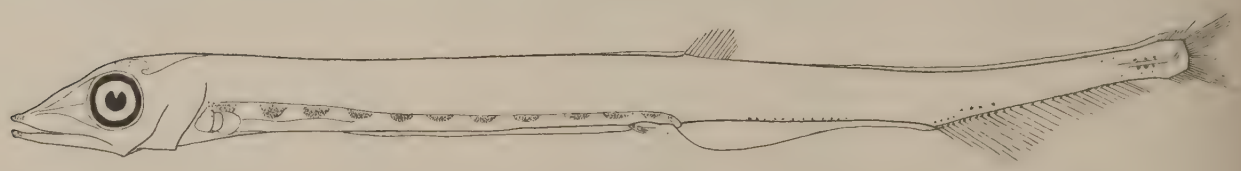
	P. pseudosphyrænoides thori	*P. pseudosphyrænoides danæ*
84	o	
83	oooooooooooooooooooooooooooooooooooooooooooooooooo	
82	ooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooo	
81	ooooo	oooo
80		oooooooooooo
79		ooooooooooo
78		oooo
	$a_{128} = 82.48$	$a_{33} = 79.52$

Consequently there is the rather large difference of about 3 between the average values in the two forms, a difference, the importance of which is perhaps better emphasized by the fact that only one variate, 81, is found common to the two forms. On the other hand a comparison between the numbers of the rays, though the material of the latter form is scanty, shows that there cannot be any appreciable difference, as far as these characters are concerned, if there is any at all.

Postlarval development. With the exception of the divergence mentioned below, the development, as regards the pigment, agrees exactly with that in the other form, there is therefore no occasion to



1



2

Fig. 19. *Paralepis pseudosphyrænoides danæ*, subsp. n. Postlarval stages, length ex. C. 1: 18 mm. (St. 1146), 2: 29 mm. (St. 829).

go through a lengthy series of stages. The two figures given here should be sufficient to illustrate the relation between the two forms in that respect.

Fig. 19, 1 shows a specimen *18 mm.* in length. The stage corresponds most closely to No. 4 of the series illustrating the other form, the specimen, however, is, in agreement with the difference in size, a little more developed. There are nine peritoneal pigment sections. As in *P. pseudosphyrænoides thori*, there are three postanal groups of chromatophores similarly situated, two ventral, of which the foremost is behind the dorsal fin at a distance from it almost equal to the length of the base of the fin, the hindmost above the front portion of the anal fin, and one lateral, the foremost chromatophores of which lie almost above the hindmost ray of the anal fin. In contrast to what is seen in the other form, the group consists only

of the two lateral rows, one on each side of the notochord; the ventral row is entirely lacking. The lateral rows have one or two chromatophores less than those in the other form.

Fig. 19, 2 shows a specimen *29 mm.* in length. The stage corresponds most closely to No. 6 of the series illustrating the other form. There are twelve peritoneal pigment sections, of which the hindmost lies below the foremost part of the dorsal fin, the two at the end behind the ventral fins as in the other form and as in *P. sphyrænoides*. The foremost of the three postanal groups of chromatophores is no longer to be seen, the other two on the contrary are distinctly visible, the hindmost group consists of only two rows in this older specimen as well, a secondary pigment in the form of rather short rows of small chromatophores, similarly situated to those in the corresponding stage of *P. pseudosphyrænoides thori*, has developed.

7. PARALEPIS AFFINIS, sp. n.

Rather closely related to *P. sphyrænoides* and *P. pseudosphyrænoides* is a new species, which in some respects agrees so far with one of the said species or with both of them that only a more thorough comparative investigation can establish the actual differences; in other respects, particularly as regards pigmentation, it differs so much from the other two species that there can be no doubt that it is more distantly related to either of them than these are to each other.

Measurements. The species, of which a very great number of postlarval specimens is at hand, is represented only by two fairly old individuals respectively 103 and 75.5 mm. long. In the following, the different measurements in these two fairly large specimens and also in three postlarval ones, are given. The measurements are also expressed in percentages of the total length excl. caudal fin. The numerals refer to the following informations:—

No. 1. — R/S "Dana", St. 1165, 4000 m. w.
» 2. — » » 1159, 3000 —
» 3. — » » 1335, 150 —
» 4. — » » 1323, 300 —
» 5. — » » 1332, 200 —

	mm.					% of Tot. ex. C.				
	1.	2.	3.	4.	5.	1.	2.	3.	4.	5.
Total length	108	80	48.5	37	28.5					
Total length excl. caudal fin	103	75.5	47.5	36.0	27.0					
Predorsal length	62.5	45.9	29.2	22.4	17.3	60.7	60.7	61.5	62.2	64.1
Preventral length	54	39.0	24.7	19.1	14.8	52.4	51.7	52.0	52.9	54.8
Preanal length	58.5	42.8	27.3	21.0	16.3	56.8	56.7	57.5	58.3	60.4
Length to origin of anal fin	79.5	59.4	37.6	28.8	22.0	77.2	78.7	79.2	80.0	81.5
Length of head	19	12.3	6.8	4.9	3.4	18.4	16.3	14.3	13.6	12.6
Length of snout	8.7	5.1	2.8	2.1	1.6	8.4	6.8	5.9	5.8	5.9
Diameter of eye	4.1	2.4	1.3	1.0	0.8	4.0	3.2	2.7	2.8	3.0
Length of dorsal fin at base	2.7	1.8	1.0	0.7	..	2.6	2.4	2.1	1.9	..
Length of anal fin at base	17.7	11.9	7.8	5.6	4.1	17.2	15.8	16.4	15.6	15.2
Distance from anal fin to caudal fin	1.3	1.1	0.6	..	..	1.3	1.5	1.3	..	..
Distance from anal fin to end of vertebral column	6.2	4.1	2.3	1.6	1.2	6.0	5.4	4.8	4.4	4.4
Distance from adipose fin to caudal fin	1.5	1.3	0.7	..	..	1.5	1.7	1.5	..	..

	mm.					% of Tot. ex. C.				
	1.	2.	3.	4.	5.	1.	2.	3.	4.	5.
Distance from adipose fin to end of vertebral column	5.7	4.2	2.5	..	..	5.5	5.6	5.3	..	..
Greatest height of body	9.0	4.8	2.5	1.5	1.3	8.7	6.4	5.3	4.2	4.8
Height at insertion of pectoral fins	8.5	4.8	2.1	1.5	1.3	8.3	6.4	4.4	4.2	4.8
Height at insertion of ventral fins	8.2	4.2	2.5	1.4	1.1	8.0	5.6	5.3	3.9	4.1
Height at foremost ray of anal fin	6.5	4.0	2.2	1.3	1.0	6.3	5.3	4.6	3.6	3.7
Height at hindmost ray of anal fin	3.6	2.3	1.2	0.8	0.7	3.5	3.0	2.5	2.2	2.6

Besides the usual differences in respect of the length of the head and the snout and also the height measurements between the different stages, changes, though small, can, as regards this species, be pointed out in the predorsal, the preventral and the preanal length, the values of which lengths seem to be fairly unchanged in the two last mentioned species.

In illustration of the remaining relations of *P. affinis* to the other two species in respect of measurements, the measurements in the large specimen, expressed in percentages of the total length excl. caudal fin, are placed side by side with those in the largest but one of the examined specimens of *P. sphyrænoides* and in the large specimen of *P. pseudosphyrænoides*. No. 1 indicates *P. affinis*, No. 2 *P. sphyrænoides* and No. 3 *P. pseudosphyrænoides*. Besides these, there are measurements in the largest but one specimen of *P. affinis* (1 a) and in a specimen of *P. sphyrænoides*, 60 mm. in length (2 a):—

	1.	2.	3.	1 a.	2 a.
Total length	108	153	95.5	80	64
Total length excl. caudal fin	103	150	92	75.5	60
Predorsal length	60.7	59.3	58.6	60.7	58.2
Preventral length	52.4	53.3	52.2	51.7	52.0
Preanal length	56.8	59.3	58.2	56.7	58.8
Length to origin of anal fin	77.2	77.3	77.7	78.7	77.8
Length of head	18.4	18.7	21.2	16.3	16.8
Length of snout	8.4	8.7	10.3	6.8	7.7
Diameter of eye	4.0	4.1	4.3	3.2	3.3
Length of dorsal fin at base	2.6	4.3	4.1	2.4	4.0
Length of anal fin at base	17.2	16.0	16.1	15.8	16.7
Distance from anal fin to end of vertebral column	6.0	5.3	5.8	5.4	5.2
Distance from adipose fin to end of vertebral column	5.5	5.7	5.8	5.6	5.5
Greatest height of body	8.7	6.3	8.0	6.4	5.8
Height at insertion of pectoral fins	8.3	6.3	7.6	6.4	5.8
Height at foremost ray of anal fin	6.3	5.0	5.7	5.3	4.8
Height at hindmost ray of anal fin	3.5	2.7	3.0	3.0	2.8

It appears from a comparison between the three larger specimens that *P. affinis* differs from both the other species in having a considerably shorter base of the dorsal fin and a somewhat greater height of body, in which latter respect it is most different to *P. sphyrænoides*. From *P. pseudosphyrænoides* it differs, besides, by having a shorter head (and snout), while in respect of these lengths it seems to agree with *P. sphyrænoides*. The two younger specimens of *P. affinis* and *P. sphyrænoides* show the same difference as the older ones in respect of the length of the base of the dorsal fin, whereas the height measurements are about the same. Nor can any difference, as regards the length of head, be pointed out in these specimens.

Dentition. The large specimen, 103 mm. in length, presents the following dentition (Fig. 20). Each of the premaxillaries has in front three slightly curved teeth (abt. 0.2 mm.), after a short interval six curved teeth (0.15—0.2 mm.) inclining backward, and after yet another interval eighteen small curved teeth (0.1 mm.), the foremost are inclined backwards and the hindmost forwards. On each palatine, to the front, are three erect, straight teeth (0.3—0.4 mm.), close up to each of these is a short tooth and after them follow nine curved teeth (0.1 mm.). The lower jaw has, in front on either side, two slender, erect, slightly curved teeth (0.4 and 0.3 mm.) After an interval follows a couple of shorter teeth and then, with intervals between each of them, five slender, straight, erect teeth (abt. 0.85 mm.). Close up to the long teeth is a smaller one, the length of which is $^1/_3$—$^1/_2$ of that of the principal tooth. Further back there is a single tooth of the same shape as the five large ones, but barely half as long. The average length of the larger teeth in the lower jaw amounts to 9.8 % of the length of the snout.

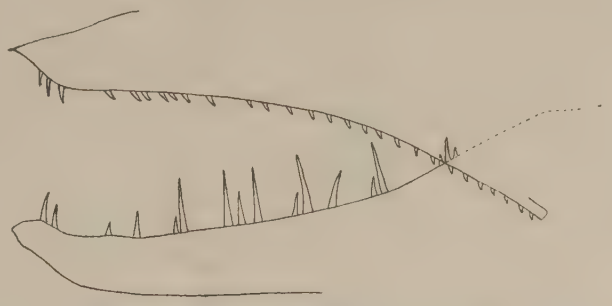


Fig. 20. *Paralepis affinis*, sp. n. Length ex. C. 103 mm. (St. 1165). Premaxillary and mandibular dentition.

A comparison between the dentition described above and that found to exist in the large specimen of *P. pseudosphyrænoides*, 92 mm. in length, which is at approximately the same stage of development, shows, on the whole, an agreement between the two species. The greatest difference may perhaps be found in the average length of the larger teeth in the lower jaw in proportion to the length of the snout, which length in the specimen of *P. pseudosphyrænoides* amounts to only 8.4 % of the length of the snout,

Numerical values. The large adolescent specimen has the following numbers of rays and vertebræ:—

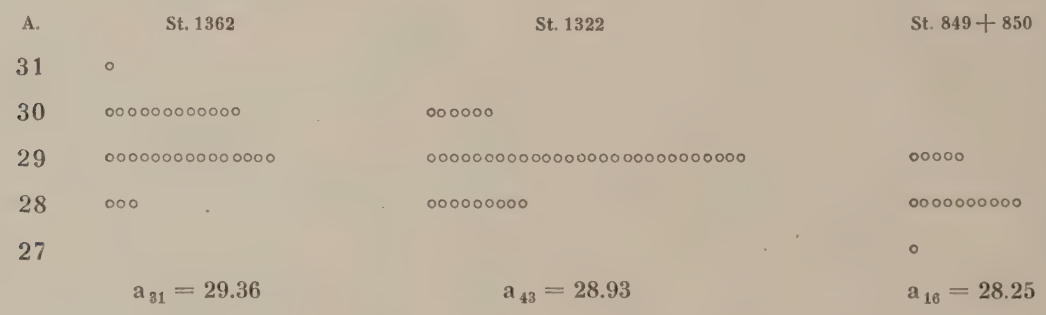
D.	A.	P.	V.	C.	R.br.	Vert.
10	29	11	9	12/19/12	7	80

An examination of the numbers of rays in the larger postlarval specimens has given the following result:—

Station No.	Tot. ex. C. mm.	D.	A.	P.	V.	R.br.
859	43	..	..	11	..	..
878	45	10	28	11	9	..
897	48	..	28	11	..	..
937	46	..	..	11	9	7
»	45	..	..	..	9	7
947	52	10	28	11	9	7
950	43	10	30	11	9	7
1148	54	10	29	..	9	..
1155	60	10	29	11	..	7
»	44	10	29	11	9	7
»	46	10	29	11	9	7
»	41	10	30	..	9	7
»	42	..	29	..	9	..

Station No.	Tot. ex. C. mm.	D.	A.	P.	V.	R.br.
1157	59	10	29	11	9	..
»	57	10	30	11	..	7
1159	47	10	29	11	9	7
1160	60	10	30	11	9	8
1162	49	10	30	11	9	7
1163	53	10	28	11	..	7
1173	43	10	30	..	..	..
1183	48	..	..	11	..	..
»	37	10	..	..	..	..
»	45	10	..	..	..	..
1189	53	10	28	12	9	..
1334	58	10	29	11	..	..
1336	59	10	29	11	9	7
»	54	10	31	11	..	7
»	46	10	29	..	9	..
1362	52	10	29	11	9	7

The number of the larger rays of the caudal fin, which has been examined in 26 specimens, is with a single exception, 19. As was the case with the other species, it has been possible to count the rays in the dorsal and the anal fin in the younger specimens as well. The dorsal fin has been examined in 61 specimens in all, of these 58 have 10, two 9 and one 11 rays. The anal fin has been examined in a fairly large number of specimens. For the present only three graphs will be shown here illustrating the result of the examination of the material from three different localities, the figures from the two adjacent stations 849 and 850 being treated together:—



The first and the last of the above average values represent respectively the highest and the lowest value found.

The particularly large material of postlarval specimens has been used extensively for investigation of the number of vertebræ. Here also, for the present, only three graphs will be given showing the result of the investigation of the material from three localities, the figures from the stations 849 and 850 being treated together.

The first and the last of the average values likewise represent, respectively, the highest and the lowest value found in the material from the localities from which the number of individuals has been sufficiently large to justify their average values being considered of importance:—

Vert.	St. 1161	St. 1322	St. 849 + 850
83	ooo		
82	oooooooooooooooooooo	o	
81	ooooooooooooo	oooooooooooooo	
80	ooo	oooooooooooooooooooooooo	oo
79		oooooooooooooooooooooooo	ooooooooooooo
78		ooooooooooooo	oooooooooooooooooo
77		o	oooo
	$a_{40} = 81.60$	$a_{83} = 79.53$	$a_{37} = 78.35$

A comparison of the above numerical values with those found in *P. sphyrænoides* and *P. pseudosphyrænoides* shows the agreement between *P. affinis* and *P. sphyrænoides* in respect of the number of rays in the pectoral fins and of the branchiostegal rays, while the new species, in other respects, resembles *P. pseudosphyrænoides* with the one difference that it has still lower values than that species. The highest average value of the number of rays in the anal fin found in this species lies about a whole unit lower than the average in the latter species, and the corresponding average values of the number of vertebræ show a similar difference. *P. affinis* differs from both the other species in the smaller number of rays in the dorsal fin, with regard to which character no difference has been pointed out between the two other species.

Postlarval development. The following synopsis shows the preanal length and the length of the snout in the figured postlarval specimens:—

Total length excl. caudal (mm.)	4.3	8.5	13.5	17.5	29	43
Preanal length in % of total length	24.6	22.2	30.0	51.3	58.0	58.6
Length of snout in % of total length	abt. 4.5	4.2	3.9	4.8	5.3	6.2

In respect of the development of the preanal length matters are obviously about the same as in *P. sphyrænoides* (a specimen of this species, 19 mm. in length, shows the same value as a specimen of *P. affinis*, 17.5 mm. in length), whereas matters with regard to the development of the length of the snout are very different in the two species, as will be seen from the following figures. The figures in brackets indicate specimens of *P. sphyrænoides*, the others, specimens of *P. affinis*.

Total length excl. caudal (mm.)	8.5	(7.5)	29	(27)	43	(41)
Length of snout in % of total length	4.2	(2.4)	5.3	(5.1)	6.2	(5.3)

It will be seen, that the length of the snout which, in the older specimens, has about the same value in the two species, in the youngest postlarval specimens is about twice as large in *P. affinis* as in *P. sphyrænoides*.

Fig. 21, 1 shows a specimen *4.3 mm.* in length. An indication of the pectoral fins is already to be seen in this particularly young specimen. Pigment is, on the contrary, not found to exist (apart from that of the eye); no peritoneal pigment section is developed nor are the chromatophores on the tail, which are characteristic of the slightly older postlarval stages of the species. The shape of the body and the head, especially the relatively long snout, ought however to afford sufficient proof of the specific relations between this specimen and the one described below.

8.5 mm. (Fig. 21, 2). The intestine is shorter than the head, which is just as high as it is long. There are two peritoneal pigment sections present. The pigmentation consists otherwise only of two stellate chromatophores on the tail, placed very near the ventral median line, one situated about midway

between the anus and the end of the tail, slightly closer to the latter, and one further behind somewhat nearer to the end of the tail than to the anterior chromatophore.

13.5 mm. (Fig. 21, 3). The end of the notochord is still straight, the hypurals suggested, as is also the caudal fin; the anal fin is defined in its entire length. Three peritoneal pigment sections are developed. The large postanal, ventral chromatophores are both doubled, the posterior pair is a little behind the origin of the anal fin, and the distance from this pair to the end of the tail is distinctly shorter than to the anterior pair.

17.5 mm. (Fig. 21, 4). The end of the notochord is bent upward, the hypurals developed, most of the interspinous rays in the anal fin can be distinguished. There are eight peritoneal pigment sections. Behind the anterior pair of chromatophores mentioned at the preceding stage, five, at present, smaller chromatophores have developed, while by the side of the two above the foremost part of the anal fin a third has come in sight. Above the brain five or six fairly large chromatophores are to be seen, forming a semi-circle.

29 mm. (Fig. 21, 5). The larger rays in the caudal fin and the rays in the anal fin can be counted, the dorsal fin is indicated but its individual rays cannot yet be distinguished, the ventral fins are suggested. There are eleven peritoneal pigment sections, of which the two last indicated lie behind the ventral fins, the hindmost is still small. The foremost row of postanal, ventral chromatophores consists of nine of these, all large and stellate, the distance between each of them is greatest anteriorly. The three chromatophores above the foremost part of the anal fin are no longer to be seen. In the hindmost part of the tail, situated dorsolaterally, are two fairly large chromatophores, the hindmost almost above the point where the notochord bends upward, ventrolaterally situated, there is a short row of dot-like chromatophores and further forward a similar row situated dorsolaterally above the hindmost part of the anal fin.

43 mm. (Fig. 21, 6). All the rays in the fins can be counted, the embryonic fin is greatly reduced. There are twelve peritoneal pigment sections, the shape of the foremost differs from the rest, as will also be noticed in the preceding stage, as its longest extension is in a vertical direction, and it is pointed at the ventral end. The hindmost part of the last one developed lies, like the anus, about midway between the origin of the dorsal fin and the insertion of the ventral fins. In front of the dorsolaterally situated large chromatophores in the hindmost part of the tail, mentioned at the preceding stage, yet another has developed. The two rows of small chromatophores are elongated backwards and forwards respectively, besides this there is a third row to be seen lying close up to about the hindmost two thirds of the base of the anal fin, its hindmost end pushing itself in below the other two rows. The large chromatophores in the semi-circle above the brain are very conspicuous.

In connection with the series of figures corresponding to the above descriptions of the different postlarval stages, two figures of the two previously mentioned adolescent specimens are given.

Fig. 21, 7 shows the specimen 75.5 mm. in length. The dorsal portion of the embryonic fin is still present in part as a low edging between the dorsal fin and the adipose fin, which is very nearly formed. The pigmentation shows a close connection with that in the oldest postlarval specimen described above. The thickness of the wall of the abdominal cavity does not permit of the peritoneal pigment sections showing up distinctly from without, but they are sufficiently clear to be distinguished separately, there are eleven. The row of larger chromatophores between the anus and the anal fin is similar to that in the postlarval specimen though the stellate formation has disappeared. In the hindmost part of the tail, the same rows of chromatophores are to be seen as in the said specimen, they are not so close to the surface but can easily be distinguished. The characteristic semi-circle of large chromatophores above the brain is still distinct. Of subsequently occurring pigment, not found to exist in the postlarval specimen, is to be remarked a narrow belt, stretching along the dorsal side of the entire trunk and tail, except from the adipose fin to the back edge of the tail, consisting of tiny chromatophores, a triangular patch of pigment on the hindmost part of the tail and a row of small chromatophores along the base of the foremost

Fig. 21. *Paralepis affinis*, sp. n. Postlarval stages, length ex. C. 1: 4.3 mm. (St. 1332), 2: 8.5 mm. (St. 1332), 3: 13.5 mm. (St. 1329), 4: 17.5 mm. (St. 1328), 5: 29.0 mm. (St. 1337), 6: 43,0 mm. (St. 1335), and adolescent stages, 7: 76 mm. (St. 1159) and 8: 103 mm. (St. 1165).

third of the anal fin; on the head there is a rather dense pigment in front of and behind the aforementioned semi-circle of large chromatophores and also pigment on the foremost third of the snout.

Fig. 21, 8 shows the large specimen 103 mm. in length. The pigmentation is very different from that in the specimen described above and affords but slight or, one might almost say, no evidence of the specific identity of the two specimens. The only thing remaining of the pigmentation of the younger stage which might serve as such evidence, is the row of chromatophores between the anus and the anal fin, which chromatophores, though the number is twice as large as that in the other specimen, are at a far greater distance from each other as well as being larger than is the case in the adolescent and the older postlarval stages of the most closely related species, *P. sphyrænoides* and *P. pseudosphyrænoides*. The pigmentation of the tail is quite different, the rows of chromatophores in the hindmost part of the tail which can easily be traced at the preceding stage are not to be seen at all. The superficial pigment is formed of narrow belts lying parallel with the myomeres, covering respectively the foremost and hindmost edge of two consecutive myomeres; these belts follow the myomeres dorsolaterally still further forward on the tail to a point about midway between the origin of the dorsal fin and the back edge of the tail. The dorsal pigment belt occurring in the younger specimen is in this one more developed, while the pigmentation of the head differs particularly from that in the younger specimen in the lack of the chromatophores above the brain.

8. PARALEPIS THERMOPHILUS, sp. n.

While the species mentioned in the foregoing may be embodied in two groups, one group being characterized *inter alia* by comparatively short teeth in the lower jaw and by the position of the ventral fins behind the origin of the dorsal fin, the other by comparatively long teeth in the lower jaw and by the position of the ventral fins in front of the dorsal fin, this new species occupies an exceptional position. Its dentition is about the same as that in *P. sphyrænoides* and the species related to it, but its ventral fins are inserted below the dorsal fin. As the following will elucidate, the new species, however, is more closely related to the species of the *P. sphyrænoides*-group than to the first mentioned shortteethed species, a circumstance that confirms the significance of the length of the teeth in the lower jaw as a systematic character.

Measurements. In the largest specimen found, an adolescent individual 43.5 mm. in length, the length of the head in proportion to the total length excl. caudal fin is as 1 to 4.44 and the greatest height of the body to the total length as 1 to 12.43. The measurements of the specimen are otherwise as follows:—

	mm.	% of Tot. ex. C.
Total length	47.5	
Total length excl. caudal fin	43.5	
Predorsal length	24.5	56.3
Preventral length	24.7	56.8
Preanal length	26.0	59.8
Length to origin of anal fin	32.8	75.4
Length of head	9.8	22.5
Length of snout	4.4	10.1
Diameter of eye	1.9	4.4
Length of dorsal fin at base	1.8	4.1
Length of anal fin at base	7.6	17.5
Distance from anal fin to caudal fin	0.9	2.1

	mm.	% of Tot. ex.C.
Distance from anal fin to end of vertebral column ...	2.8	6.4
Distance from adipose fin to caudal fin	1.1	2.5
Distance from adipose fin to end of vertebral column.	3.2	7.4
Greatest height of body	3.5	8.0
Height at insertion of pectoral fins.....	3.0	6.9
Height at insertion of ventral fins.....	2.7	6.2
Height at foremost ray of anal fin	2.7	6.2
Height at hindmost ray of anal fin	1.5	3.4

The most interesting of the above measurements is the preanal length which has about the same value as in the species of the *P. sphyrœnoides*-group, while this length in the other species with the same, or about the same, position of the ventral fins in relation to the dorsal fin as the present species, amounts to about 10 % more of the total length excl. caudal fin. The present species differs slightly from all the previously mentioned species in respect of the predorsal length and the length from the point of the snout to the anal fin, which lengths amount to 2—3 % less of the total length than in any of the other species. The head is just as long as, for instance, in *P. rissoi rissoi*, but, on the other hand, only a little longer than in *P. pseudosphyrœnoides*.

Dentition. The specimen in question, 43.5 mm. in length, presents the following dentition (Fig. 22). In each of the premaxillaries, rather near the point of the snout, are two curved teeth (0.2 mm.) and after a short interval twelve curved teeth (abt. 0.1 mm.) placed rather widely apart, of which the anterior incline backwards and the posterior forwards. On each palatine, to the front, there are three fairly large teeth (0.15 mm.), further back, five smaller ones (0.05 mm.). On either side of the lower jaw, in front near the point, there is an erect, slender, slightly curved tooth (0.3 mm.), after an interval follows a little tooth and then, with an interval between each, four slender, erect teeth (abt. 0.4 mm), near by each of the two foremost is a tooth of about half their length; this space takes up the middle third of the ramus of the jaw, further back is an isolated short tooth (0.15 mm.). The average length of the large teeth in the lower jaw amounts to 9.1 % of the length of the snout.

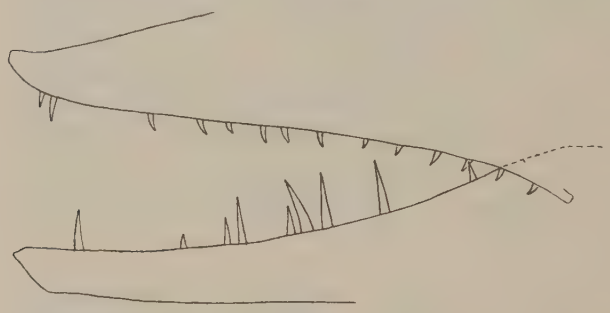
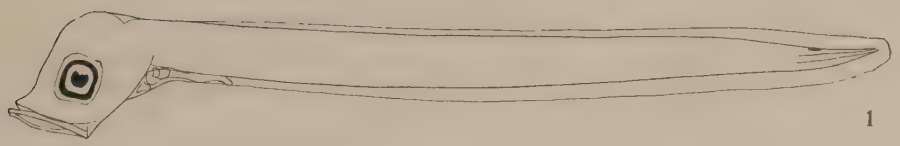
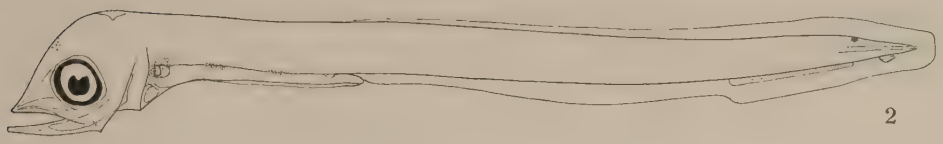


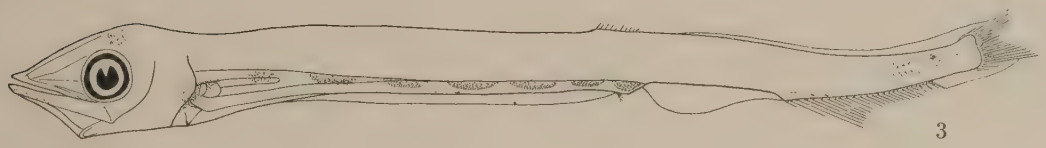
Fig. 22. *Paralepis thermophilus*, sp. n. Length ex. C. 43.5 mm. (St. 1284). Premaxillary and mandibular dentition.

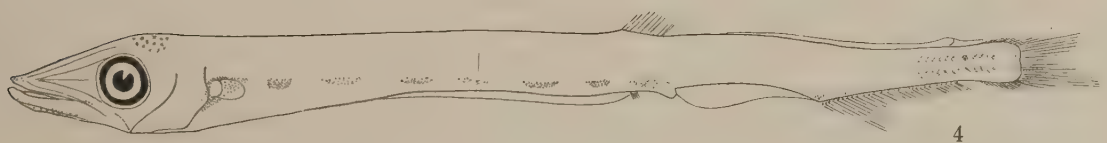
As will be seen, the dentition does not differ essentially from that found to exist in the species of the *P. sphyrœnoides*-group. A comparison between the above description and that for which a 50 mm. long specimen of *P. pseudosphyrœnoides* has in the foregoing been the object, shows an agreement on most points, the large teeth in the lower jaw are even a little longer in proportion to the length of the snout in *P. thermophilus* than in the other species.

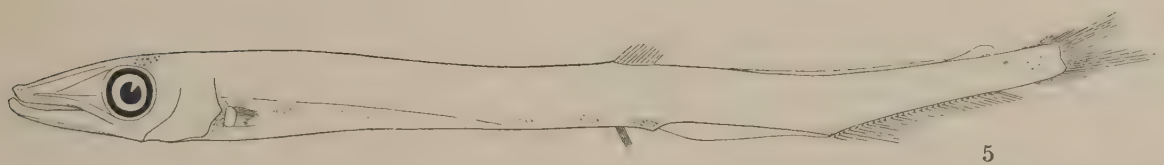
Numerical values. As the material for the investigation of the numerical characters is derived from a somewhat limited area, the waters around the Antilles, it would hardly be worth while giving the numbers of the stations for the individual observations. The material contains only three specimens sufficiently developed to admit of the rays of the paired fins being counted. The pectoral fins have 13 (in the adolescent specimen referred to), 12 and 12 rays, the ventral fins the usual number, 9. The dorsal fin











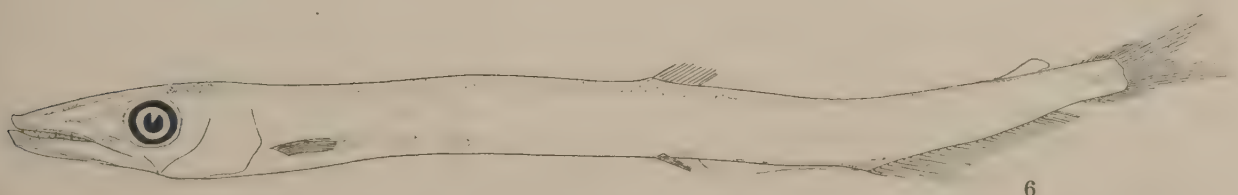


Fig. 23. *Paralepis thermophilus*, sp. n. Postlarval stages, length ex. C. 1: 6 mm. (St. 901), 2: 10.5 mm. (St. 1174), 3: 17 mm. (St. 1194), 4: 22.3 mm. (St. 1268), 5: 31.5 mm. (St. 1286) and an adolescent stage, 6: 43.5 mm. (St. 1284).

has been examined in 23 specimens which all have 11 rays. As regards the anal fin the numbers of rays found form the following graph:—

31 o o o o
30 o o o o o o o o o o o o o o o o o o o o
29 o o o o o o o

The average value of the 27 figures is = 29.93. The number of the branchiostegal rays is, in seven specimens 8, in one 7. The investigation of the number of vertebræ has given the result below:—

83 o o
82 o o o o o o o o o
81 o o o o o o o o o o o o o o o o o o o
80 o o o o

The average value of the 29 figures is = 81.28.

Postlarval development. The following synopsis shows the preanal length and the length of the snout in the figured specimens:—

Total length excl. caudal (mm.)	6	10.5	17	22.3	31.5	43.5
Preanal length in % of total length	25.6	39.2	64.4	65.8	61.5	59.8
Length of snout in % of total length	4.9	5.2	7.3	8.5	8.6	10.1

Fig. 23, 1 shows a specimen *6 mm.* in length. The height of the head is about equal to its length, the form of the eye is practically quadratic, only slightly rounded off. The pigmentation consists of a single very large, elongated chromatophore, situated dorsally near the end of the tail. This chromatophore is very prominent at all the really postlarval stages and affords an excellent means of determination.

10.5 mm. (Fig. 23, 2). The hypurals are suggested, but the end of the notochord is still straight. The length of the head is perceptibly greater than the height, the eye is rounded. The base of the anal fin is defined. There are four peritoneal pigment sections present, the difference in size between the foremost and the foremost but one is particularly pronounced. The large chromatophore near the end of the tail is rounded, on the head there are a few chromatophores above the brain and also along the front edge of the præoperculum.

17 mm. (Fig. 23, 3). This stage denotes a considerable development of the state of things in the preceding. The end of the notochord is bent upward. The anus has shifted right behind to its final place. The dorsal and the ventral fins are indicated and most of the rays in the anal and the caudal fin can be distinguished. There are eight peritoneal pigment sections which at this stage are twice as large as the interval between each of them. The large chromatophore behind the anal fin is now a little below the dorsal median line, before and behind this a pigment has developed which in front, consequently above the hindmost part of the anal fin, forms a double row of short stripes parallel with the myomeres. Furthermore there is a pigment at the base of the foremost rays of the anal fin. The chromatophores above the brain stand out with a pronounced stellate structure.

22.3 mm. Fig. (23, 4). The number of rays in the unpaired fins can be determined, the rays of the ventral fins distinguished, the pectoral fins have increased in extent but, in respect of formation, are at a similarly undeveloped stage as in the specimen described above. The place of the adipose fin is defined by a density in the embryonic fin, which still reaches right to the caudal fin. The peritoneal pigment sections, particularly those in the middle, can be seen less distinctly from without, but can still be counted; there are eight as at the preceding stage, seven in front of the dorsal fin. The aforementioned

pigment on the hindmost part of the tail follows the myomeres behind the large chromatophore as well, the number of chromatophores above the brain has increased.

31.5 mm. (Fig. 23, 5). The ventral fins are elongated, and in the upper part of the pectoral fins an indication of rays is to be seen, the adipose fin is not connected with the caudal fin. The two middlemost peritoneal pigment sections cannot be distinguished at all from the outside, the others only faintly, with the exception of the foremost and the hindmost. The short stripes of pigment running parallel with the myomeres which, at the preceding stage, were found on the hindmost part of the tail, have disappeared; whereas the large stellate chromatophore which it has been possible to follow through all the stages described in the foregoing, is still rather prominent. The fairly large chromatophores above the brain are less clearly to be seen, the intervals between them are partly filled by smaller ones.

43.5 mm. (Fig. 23, 6). The stage may if anything be considered adolescent, as but a little of the postlarval appearance has been retained. The dimensions have altered so that the height of the body at the pectoral fins is about the same as at the ventral fins, while at the preceding stage this is considerably greater at the pectoral fins, likewise, the situation of the anus is no longer marked by a sudden diminution of the height of the body. The rays of the pectoral fins can be counted; the embryonic fin is lacking, dorsally, the ventral portion is still represented by a narrow edging between the anus and the anal fin. The pigment sections of the peritoneum are not distinct, though one can faintly make out the second, third and fourth to the front ones and the hindmost. The large chromatophore is not to be seen. Near the caudal fin is a triangular patch of pigment and along the entire dorsal side of the body, as in the other species, there is a fairly narrow belt of pigment abutting anteriorly on a patch of dense pigment above the brain. Between the anus and the anal fin, along the ventral median line, a single row of small closely packed chromatophores is to be seen.

9. PARALEPIS INTERMEDIUS Poey (?).

(?) *Paralepis intermedius,* Poey, 1866—68, p. 416.
(?) *Paralepis intermedius,* Goode and Bean, 1895, p. 120.
(?) *Sudis intermedius,* Jordan and Evermann, 1896, p. 600.

The material at hand contains postlarval specimens of a *Paralepis*-form which, though not with complete certainty, is referred to the species described by Poey in 1867 which has hitherto in the literature been represented only by the type-specimen taken off the coast of Cuba.

Measurements. The ventral fins are inserted in front of the dorsal fin and the most characteristic of its measurements is the great distance between these two fins. Below will be found different measurements in one of the largest specimens taken by the "Dana" (St. 1172, 300 m. w.):—

	mm.	% of Tot. ex. C.
Total length	45.7	
Total length excl. caudal fin	43.5	
Predorsal length	27.5	63.2
Preventral length	21.9	50.3
Preanal length	23.6	54.3
Length to origin of anal fin	32.0	73.6
Length of head	7.2	16.6
Length of snout	3.8	8.7
Diameter of eye	1.5	3.4
Length of dorsal fin at base	1.0	2.3

	mm.	% of Tot. ex. C.
Length of anal fin at base	9.8	22.5
Distance from anal fin to end of vertebral column	1.9	4.4
Distance from adipose fin to end of vertebral column	1.9	4.4
Greatest height of body	3.0	6.9
Height at insertion of pectoral fins	2.9	6.7
Height at insertion of ventral fins	2.6	6.0
Height at foremost ray of anal fin	1.9	4.4
Height at hindmost ray of anal fin	0.9	2.1

In view of a comparison with the measurements given by POEY for his specimen, the following measurements must also be expressed thus:— The greatest height of the body lying at the pectoral fins is contained 15.0 times, the height of the body at the middle of the fish 16.7 times in the total length excl. caudal fin; the length of the head is contained 6.0 times in the total length excl. caudal fin, the diameter of the eye 2.6 times in the length of the snout. POEY mentions that the height of the body is contained 17 times, the length of the head $5^1/_2$ times in the length, and the diameter of the eye $3^1/_2$ times in the length of the snout. The measurements of the postlarval specimen thus differ from the measurements found by POEY only in respect of the last mentioned proportion; this disagreement may be explained by the fact that the two specimens are at very different stages of development, POEY's specimen being 236 mm. in length. POEY furthermore states that the distance from the ventral fins and the anal fin to the dorsal fin is the same; in the postlarval specimen the dorsal fin lies nearer to the anal fin than to the ventrals. As, however, the difference between the two distances is greater in the younger postlarval specimens, it may reasonably be assumed that an advance also takes place from the older postlarval to the adult stage. On the other hand, POEY's statement, that the distance from the origin of the anal fin to the insertion of the ventral fins is the same as from the same point to the caudal fin, is in agreement with the state of things in the postlarval specimen. With reference to the adipose fin POEY states:— "..... no puedo descubrir una 2ª dorsal posterior, ni una adiposa, y creo que no existe." In the larger postlarval specimens an indication of an adipose fin is to be seen, but it is very small in comparison with that of the other species and might easily escape notice. This circumstance is also in favour of a specific identity of POEY's specimen and the present postlarvæ.

Dentition. The dentition is as yet only slightly developed in the above mentioned postlarval specimen, 43.5 mm. in length, (Fig. 24) and unfortunately thus gives a rather bad basis for a comparison with that in POEY's specimen. Each of the premaxillaries has ten curved teeth of which the foremost but one is 0.2 mm., the rest about 0.1 mm. long; those in front incline backward, those behind forward. On each palatine, to the front, are four fairly large curved teeth (abt. 0.1 mm.), followed by four smaller ones. On each side of the lower jaw there is an erect, slender, slightly curved tooth (0.25 mm.) rather close to the point. After an interval follow five similar slender teeth with large intervals between them, the second and third of these are twice as large as the other three (abt. 0.4 mm.) and peculiarly shaped, as, seen from the back, the points bend sharply backwards, while in front the curve is slight and even. The average length of the large teeth in the lower jaw amounts to 10.5% of the length of the snout.

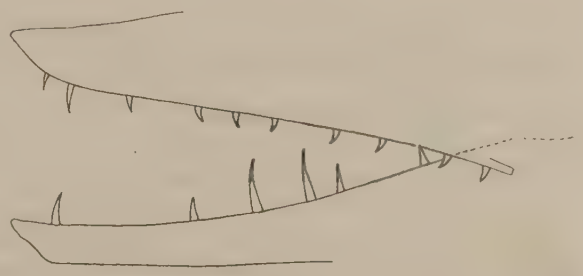


Fig. 24. *Paralepis intermedius* Poey? Length ex. C. 43.5 mm. (St. 1172). Premaxillary and mandibular dentition.

POEY mentions that in the lower jaw, besides the two canines in front, there are twelve large

teeth of which those in the middle are the largest, "all with the ends cut out from behind". There seems to be a connection between this expression and the above mentioned difference in the contours of the long teeth in the postlarvæ. As regards the difference between the number of teeth in the lower jaw, as well as in the premaxillaries, in which latter POEY found about 100 particularly small teeth, the case is similar to that known in the other species in regard to the difference between the postlarval and the adult stages.

Numerical values. As the material for the investigation of the numeral characters, like that in the case of the preceding species, is derived from a rather limited area, the individual observations will not be referred to the localities where each single specimen has been taken. The number of rays in the specimen mentioned must however be stated:— D. 10, A. 43, P. 11 and V. 9. It has been possible to determine the number of rays in the paired fins in six specimens with the same result, 11 rays in the pectoral and 9 in the ventral fins. The number of rays in the dorsal fin examined in sixteen specimens is, likewise, invariable, *viz.* 10. The number of rays in the anal fin, determined in eighteen specimens, gives the following graph:—

44 o o o
43 o o o o o o o o o o o o
42 o o o o

The average value is = 42.94. The number of the branchiostegal rays is 8. The investigation of the number of vertebræ has given the following result:—

94 o o o o o o o o o o
93 o o o o o o o o o
92 o o

The average value of the 21 figures is = 93.38.

POEY has found 15 rays in the pectoral, 10 in the ventral fins, 7 or 8 in the dorsal fin and the rays of the anal fin "en número considerable". The rays of the dorsal fin are mentioned as being very weak ("endebles"). With the exception of the pectorals for which, it may be assumed, the number stated was arrived at by splitting some of the rays, which in this way have erroneously been reckoned twice, the fins do not seem to differ much from those of the postlarval specimens; in any case, there is an agreement in respect of a small number of rays in the dorsal and a large number in the anal fin.

Postlarval development. The following synopsis shows the preanal length and the length of the snout in the figured specimens:—

Total length excl. caudal (mm.)	8.2	11.3	13.5	20.5	26.0	43.5
Preanal length in % of total length	23.8	39.2	45.9	52.5	54.6	54.7
Length of snout in % of total length	3.7	4.5	6.1	6.7	7.4	8.1

Fig. 25, 1 shows a specimen *8,2 mm.* in length. The anus lies at a distance from the head about equal to the height of the latter, the length of the head is somewhat greater than its height. An indication of the base of the anal fin can be traced as a slight density in the embryonic fin. The foremost peritoneal pigment section is present, the body is otherwise without pigment; only on the embryonic fin, immediately in front of the end of the tail, both dorsally and ventrally, there are five to seven fairly large chromatophores.

11.3 mm. (Fig. 25, 2). The most essential difference from the preceding stage is the situation of the anus, which has shifted back to a point about midway between the point of the snout and the anal

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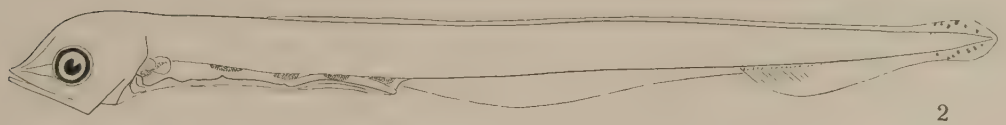

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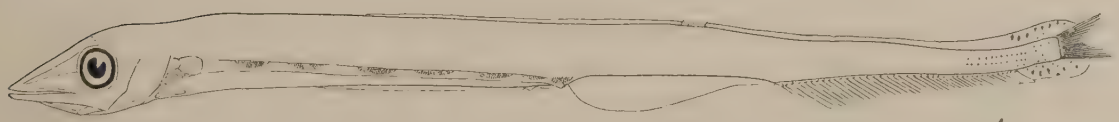

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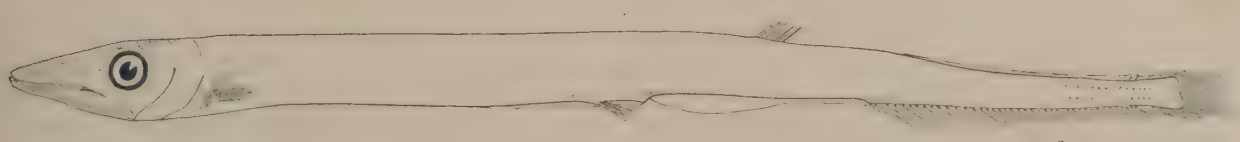

6

Fig. 25. *Paralepis intermedius* Poey (?) Postlarval stages, length ex. C. 1: 8,2 mm. (St. 1172), 2: 11.3 mm. (St. 1223), 3: 13.5 mm. (St. 1191), 4: 20.5 mm. (St. 1289), 5: 26 mm. (St. 1278) and 6: 43.5 mm. (St. 1172).

fin. The height of the myomeral body is somewhat less and the tail is not so abruptly pointed than at the younger stage. The foremost interspinous rays of the anal fin can be seen singly, a few rays are distinguishable, the pectoral fins are indicated. There are five peritoneal pigment sections. The aforementioned chromatophores on the embryonic fin, round the end of the tail, stand out more distinctly and there is, in addition, quite a short row of small chromatophores near the end of the tail along the dorsal median line, on the tail itself.

13.5 mm. (Fig. 25, 3). The end of the notochord is bent slightly upward; the caudal fin is indicated, and the base of the anal fin is defined. There are seven peritoneal pigment sections, the hindmost is still very small. The pigment in the hindmost part of the tail consists of four rows of small chromatophores, namely, besides the dorsal, which was present at the preceding stage, of one ventral and two lateral.

20.5 mm. (Fig. 25, 4). The end of the notochord is very much bent upwards and the back edge of the tail is vertical to the longitudinal axis. The anus occupies about its final position. Most of the rays of the anal fin can be distinguished, the dorsal fin is suggested by a density in the embryonic fin, furthermore there is a faint indication of the ventral fins. There are eight peritoneal pigment sections. The two lateral rows of pigment at the end of the tail are lengthened anteriorly. In the hindmost part of the embryonic fin there are a few small chromatophores in addition to the large ones occurring at the preceding stage, above the brain is a semi-circular row of small chromatophores.

26 mm. (Fig. 25, 5). The number of rays in the anal fin can be determined, that of the dorsal fin not yet with certainty, the ventral fins are still very small, the adipose fin is suggested. There are, as at the preceding stage, eight peritoneal pigment sections, which number seems to be the final average number of the species. Seen from without, they are narrow and short, excepting the foremost and the two hindmost, as their upper portions are hidden. With the development of the smaller rays of the caudal fin, most of the chromatophores in the embryonic fin have disappeared, the dorsal and ventral of the four rows of small chromatophores on the end of the tail are indistinct. Pigment is to be seen at the base of the foremost rays of the anal fin and also on the jaws.

43.5 mm. (Fig. 25, 6). All the rays in the fins can be counted. The embryonic fin is reduced, but, besides on the part of the body where it is retained longest, namely between the anus and the anal fin, it is, however, still present, dorsally, from about the vertical of the origin of the anal fin to the caudal fin, ventrally, in addition to being on the part of the body mentioned, it is present in front of the ventral fins as well. The adipose fin stands out more distinctly, but is still connected with the caudal fin. Of the peritoneal pigment sections the foremost, vertically elongated one, is to be seen rather distinctly, a couple of the hindmost faintly, while the remaining portion of the row is entirely hidden. The chromatophores of the two lateral rows on the hindmost part of the tail are perceptibly larger than at the preceding stage. On the head a pigment has developed behind the aforementioned semi-circle of isolated chromatophores, and the pigment on the jaws and the point of the snout has increased.

Parr (1928, p. 46) mentions, under the name *Lestidium intermedium*, two specimens, 73 and 80 mm. long. The author considers that, in respect of all important characters, he has found perfect agreement between these and Poey's *Paralepis*-specimen and thus is justified in specifically identifying them with that species. Parr calls attention to the fact, that the specimens examined by him have a smaller eye than Poey's specimen, but considers that this may be due to their difference in size. The disagreement is, however, so great — in Poey's specimen the diameter of the eye is contained $3^1/_2$ times, in Parr's specimen only twice in the length of the snout — that it alone would seem to exclude a possibility of a specific identity, considering the comparatively advanced stage that Parr's specimens have reached.

The material at hand contains an adolescent specimen 100 mm. in length, and also several postlarvæ of a *Paralepis*-like form, which, in respect of measurements, such as the size of the eye in proportion to the length of the snout and the position of the dorsal fin about midway between the ventral

fins and the anal fin, agrees very well with PARR's specimens. Furthermore, in this *Paralepis*-like form there is found to exist a special peculiarity which PARR mentions, namely that the symphysis of the lower jaw has a pointed, osseous projection directed straight forward. The numerical values are somewhat indefinitely stated by PARR, except the number of rays in the anal fin and the number of vertebræ. PARR finds 20—23 rays in the anal fin; the specimens in the material at hand have 22—24. PARR finds 84 vertebræ; the aforementioned specimens have 82—85. These characters, in conjunction with those mentioned above, should furnish sufficient evidence for the specific identity between the specimens examined by PARR and those examined by me.

PARR reports "about 10" rays in the dorsal fin; the 30 specimens examined by me had, however, (12—)13 rays. This number cannot be reconciled with the 7 à 8 rays found by POEY, and the number of rays in the anal fin can hardly be said to be covered by POEY's expression "en número considerable"; besides the rays are comparatively strong. Finally, the form has a well developed adipose fin.

The form referred to above differs in so many respects — the short distance between the dorsal and the anal fin, this distance being only a little greater than the length of the base of the dorsal fin, that length, the peculiar formation of the symphysis of the lower jaw, the distinctive circumstances in the development of the intestinal canal situated as it is, at the youngest postlarval stages, below the head, the postlarval pigmentation which, at the youngest stages, already consists of a long row of large chromatophores along the ventral edge of the myomeral body — from the state of things in the genus *Paralepis*, that it has not been possible to refer it to that genus, and it has therefore not been included in the present investigation.

III. BIOLOGICAL INVESTIGATIONS.

A. THE INDIVIDUAL SPECIES.

The postlarval specimens which, numerically, form by far the great majority of the material used in this work, have been made the basis of the biological investigations. As regards most of the species the investigation of the different parts of the area in question, made by the Danish expeditions, has been sufficiently thorough to make it possible to determine the limitation of the geographical distribution of the postlarvæ in this area. As most of the species are also represented by a sufficient number of specimens for the investigation of the vertical distribution of the postlarvæ, the conditions for testing the relation between vertical and horizontal distribution of the latter have been present.

1. PARALEPIS RISSOI Bonaparte.

a. PARALEPIS RISSOI RISSOI Bonaparte.

Material. The material consists of 511 postlarval specimens (and also the aforementioned large specimen taken at St. 120 with 300 m. w.). Of these, 389 specimens were collected in the Mediterranean, 315 by the "Thor" and 66 by the "Dana" in the Alboran Sea and the south-western portion of the Balearic Sea, while the rest, 122 specimens, were taken in the Bay of Cadiz and the adjacent parts of the Atlantic, mostly by the "Dana".

Horizontal distribution. The species was in earlier times known from Nice (Cuv. and Val. 1829, Bellotti 1877, Sarato 1887) and Messina (Bellotti); in more recent times it has been taken in the southern portion of the Adriatic at about 42° N. lat. and about 17° E. long. (Pietschmann 1914). It is also reported as occurring off the Algerian coast (Guichenot 1850) and in the Aegean Sea (Erhard 1858). Finally it has been found south-west of Cape Finisterre at 42° 18′ N. lat. and 12° 08′ W. long. (Roule and Angel 1930).

The catch of the postlarval specimens made by the "Thor" in the Mediterranean is fairly evenly distributed over the investigated parts of this sea. No specimen, however, was taken in the Aegean Sea, in the area between the south-west coast of Sicily and Africa, and in the main part of the Catalonian Sea. These three areas, within which the negative results can hardly be due to insufficient investigation, lie within the 1000 meter isobath, a circumstance which may perhaps account for these negative results. Specimens have, it is true, been taken at several places within this limit and at a few places within the 200 meter isobath, but in all these instances, not far from the 1000 meter limit. On the other hand a difference between the eastern and the western part of the Mediterranean is not apparent, as the form is found from Gibraltar right up to Rhodes. Nor is there any northern limit, specimens having been taken far inside the Gulf of Genoa, but not at the most northerly station, St. 124, which lies within the 200 meter line.

Outside the Mediterranean the form was taken in the Bay of Cadiz and also at Madeira and in the vicinity of this island, to a western limit of about 22° W. long.

Vertical distribution. In the following a synopsis is given showing the division among the different lengths of wire of the main material, namely that collected by the "Thor" in the Mediterranean. By the side of the summarized result each size-group is considered by itself and each number of specimens — except in the case of the youngest size-group which contains only a few individuals — is expressed in proportion to the aggregate number of hours in which fishing was carried on with the length of wire in question, at all the stations positive for the catch of the form. The figures thus arrived at do not, of

course, give any precise expression of the relation between the different depths which correspond to the lengths of wire; particularly will a less number of hours, only a slight use of a length of wire, give occasion for a rather different result to what is the actual state of things; one will, however, approximately, on broad lines, get quite a good conception of the matter. The material was collected partly in December to February, partly in June to September. The winter and summer materials are treated separately.

		M. W. 25	65	100	150	200	300	400	600	1000	>1000
Winter	Number of hours	11	14	3½	3½	4½	12	½	3½	2	10½
Summer	do.	11½	2¾	⅛	⅛	0	14⅛	0	3½	7	13
	Length < 10 mm.										
Winter	Number of specimens	1	1	..	..	3	..	..	..	..	.
Summer	do.	..	..	..	..	..	11	..	..	..	2
	Length 10—15 mm.										
Winter	Number of specimens	3	12	7	..	5	7	..	4	4	1
	No. of specimens div. by no. of hours	0.3	0.9	2.0	..	1.1	0.6	..	1.1	2.0	0.1
Summer	Number of specimens	1	..	..	..	..	80	..	1	4	12
	No. of specimens div. by no. of hours	0.1	..	..	..	..	5.6	..	0.3	0.6	0.9
	Length 15—25 mm.										
Winter	Number of specimens	2	5	1	..	10	22	2	2	1	..
	No. of specimens div. by no. of hours	0.2	0.4	0.3	..	2.2	1.8	4.0	0.6	0.5	..
Summer	Number of specimens	1	..	..	..	..	67	..	12	5	..
	No. of specimens div. by no. of hours	0.1	..	..	..	..	4.7	..	3.4	0.7	..
	Length > 25 mm.										
Winter	Number of specimens	..	..	..	..	..	1	..	3	1	2
Summer	do.	..	..	..	..	..	3	..	3	1	3
	The entire material										
Winter	Number of specimens	6	18	8	..	18	30	2	9	6	3
	No. of specimens div. by no. of hours	0.5	1.3	2.3	..	4.0	2.5	4.0	2.6	3.0	2.9
Summer	Number of specimens	2	..	..	..	..	161	..	16	10	26
	No. of specimens div. by no. of hours	0.2	..	..	..	..	11.2	..	4.6	1.4	2.0

The division of the material collected by the "Dana" in the Alboran Sea and the south-western portion of the Balearic Sea, at the close of September and the beginning of October 1921, is as follows:—

	M. W. 25	50	100	150	200	250	300	400	500
Number of hours	2	3	11½	10½	13½	5½	10	2	1
Number of specimens < 10 mm.	..	..	..	..	..	..	4	..	2
do. 10—15 »	..	..	..	..	..	1	9	3	24
do. 15—25 »	..	..	..	..	1	2	8	3	9
The entire material									
Number of specimens	..	..	..	..	1	3	21	6	35
No. of specimens div. by no. of hours	..	..	..	..	0.1	0.5	2.1	3.0	35.0

As will be seen from the above, a considerable difference prevails in respect of the vertical distribution in winter and in summer. An approximate determination of the size of this difference cannot, however, be arrived at from the material, for the reason that the use of the several lengths of wire has been somewhat different on the two cruises. The most — and each to about the same extent — used lengths of wire, 25 and 300 meters, have, however, been employed in about an equally high degree winter and summer, so that the material derived from catches with these two lengths of wire can form an efficient basis for the testing of the relation between the corresponding depths. On the other hand, the intermediate lengths of wire were used far more on the winter than on the summer cruise, 100 and 150 m. w. so sparingly on the latter that there was but little chance of catches, 200 m. w. was not used at all.

The seasonal difference mentioned is most pronounced in the smallest specimens (< 10 mm.), less so in the larger, and does not appear at all in the largest (> 25 mm.). The most important specimens from a biological point of view, the smallest, are unfortunately few in number; though their occurrence in winter, both near the surface and further below, in summer, only further below, is in agreement with that of the smallest but one specimens (10—15 mm.). We find from these that the catch per hour in winter is fairly evenly divided among the different lengths of wire, the catch with 25 m.w. is somewhat less, but still about half as large as with 300 m.w., while in summer the catch with 25 m.w. is quite insignificant in comparison with what was achieved with 300 m.w., 1 specimen to 80 in about the same time. As regards the intermediate lengths of wire it is, as stated, difficult to make a comparison, though the negative result of the $2^3/_4$ hours haul with 65 m.w. may very well show that the occurrence is far more scarce at a depth corresponding to this length of wire than at a depth corresponding to 300 m.w.

We also find specimens of the next size-group (15—25 mm.) taken in winter with the smaller lengths of wire, but a shifting downwards has, however, taken place, so that with 300 m.w. 10 times as many specimens have been taken as with 25 m.w.; this proportion is, however, still far greater in summer, at which time of the year 52 times as many specimens were taken per hour with 300 m.w. as with 25 m.w., which means, that the same state of things exists as in the preceding size-group. The entire absence of a seasonal difference shown by the largest specimens (> 25 mm.) is due, possibly, to deficient material.

Finally, as regards a table of the aggregate material, this might, in a minor degree, be considered appropriate in respect of the shifting during growth pointed out in the foregoing. As, however, the results for the individual size-groups refer to somewhat small numbers of specimens, it may also be of interest to get the difference between the two seasons expressed by means of the entire material.

The supplementary material taken by the "Dana" at the close of September and the beginning of October, at a time of the year when the temperature of the water was about the same as during the summer cruise of the "Thor", likewise shows a negative result with smaller lengths of wire up to 150 m. incl., despite the greater use of 100 and 150 than, for instance, of 300 m.w,, and small catches with 200 and 250 m.w. as compared with the result given by lengths of wire of 300 m. and more. It must, however, be remarked at once that the materials cannot be compared directly.

It has, unfortunately, not hitherto been possible to calculate exactly the proportion between a given length of wire and the depth reached by the fishing apparatus attached to the end of the wire, as the depth depends on different factors, all of which cannot be determined with certainty. When not working with too great a length of wire (up to abt. 500 m.) and with only a single apparatus attached to it, as was the case during the cruises of the "Thor", the depth, with the vessel making two knots, is considered to be about half that of the length of wire, *inter alia* in agreement with the experiments made with Clausen's bathymeter in the summer of 1907 (*vide* Schmidt, 1912, p. 13). The working method on the "Dana", of using several fishing apparatus at one time, demands a greater length of wire for the same depth. The proportion between the length of wire and the depth is estimated to be somewhere about 3 to 1, when lengths of wire smaller than about 500 m. are used and the vessel is making about

2½ knots. Thus it will be seen, that the use of a length of wire of 200 m. during the summer cruise of the "Thor" would certainly have occasioned a, relatively, not inconsiderable catch, while that would hardly have been the case with respect to the smaller lengths of wire.

The aggregate result of the investigations is, that the smallest and fairly small postlarvæ are, during winter, taken to about the same extent both with the smaller and the greater lengths of wire, while during summer the catches with smaller lengths of wire are quite insignificant. The most obvious explanation for this circumstance is, that there is a certain connection between a maximum temperature, which cannot very well be much higher than the surface temperature in winter, and the limitation, taken generally, of the vertical occurrence of the young postlarval specimens. The summer temperature at a depth of 100 meter is not very different from what prevails in winter both in the more superficial layers of water and at the above mentioned depth as well.

Outside the Mediterranean the form, as stated, was taken in the Bay of Cadiz and the adjacent portions of the Atlantic. A survey is given below of the distribution of the specimens caught by the "Dana" in this area from the 13th of September to the 20th of October:—

M. W.	25	50	100	150	200	250	300	400	500	600
Number of hours	6	16¼	34¼	1½	36¾	0	35¾	22¼	14	2
Number of specimens < 10 mm.	..	..	..	..	..	..	12	1	7	3
do. 10—15 »	..	..	..	..	5	..	35	5	6	2
do. 15—25 »	..	..	..	..	14	..	18	..	2	4
The entire material										
Number of specimens	..	..	..	..	19	..	65	6	15	9
No. of specimens div. by no. of hours	..	..	..	..	0.5	..	1.8	0.3	1.1	4.5

This material, then — in conformity with the time of year it was collected — is wanting in specimens taken with fairly small lengths of wire and, as regards the smallest size-group, in specimens taken with any length of wire less than 300 m. In respect of this size-group, it may further be stated, that of the 12 specimens taken with 300 m.w. only one is smaller than 8 mm., while amongst the 10 specimens taken with 500 and 600 m.w. there are two 7 mm. and two 6 mm. in length, so that the occurrence of the smallest postlarvæ must practically be assigned to a depth corresponding to these lengths of wire which, approximately, should be 200 m.

What takes place as regards the distribution of the postlarvæ during the winter months in the Atlantic, cannot be determined for want of material, very likely there is a similar difference between winter and summer as what is shown to prevail in the Mediterranean.

Relation between vertical and horizontal distribution. As mentioned, the material seems to show that the vertical occurrence of the smallest postlarval specimens in the Atlantic, during the hot time of the year, may practically be assigned to a depth of about 200 m. On the chart, Fig. 26, which shows the geographical distribution of the postlarval specimens, isotherms *inter alia* are placed in the area of distribution of the Atlantic, in the way they (according to Schott, 1912) prevail at a depth of 200 meters. As will be seen, the course of the 15°- and 16°- isotherms explains quite well the southern limit of the distribution and partially its western limit. On the other hand, a more northerly occurrence in the area between the Bay of Cadiz and the Azores is lacking. That the temperature, nevertheless, dictates the limits of the distribution, is evident from the fact, that the same temperature, about 16°,[1]) is the highest that occurs in the Mediterranean at the stations and the depths where the smallest postlarvæ were taken.

[1]) All the values of temperature in the present paper are in Centigrade.

The vertical distribution of the smallest postlarvæ in the Mediterranean ought, likewise, to explain that postlarvæ are found somewhat evenly distributed over the whole of this sea, in spite of the great differences which prevail also with respect to the temperature between its different areas. The particular depth-occurrence in the hot season results in the difference between the extreme temperatures, within

Fig. 26. Distribution of the postlarvæ of: ● *Paralepis rissoi rissoi* Bonaparte and ○ *Paralepis rissoi krøyeri* Lütken. The broken lines with dots indicate the isotherms at a depth of 200 meters, the others the isotherms at a depth of 150 meters (after Schott 1902).

which the postlarvæ occur, being reduced very considerably, indeed it is far less than the difference between the extreme temperatures which, in the course of the year, occur at or near the surface, even within a very limited area.

Propagation. Small postlarval specimens, < 15 mm. in length, were taken from the middle of December to the 20th of February and from the end of June to the 20th of October and also in the middle of March (Messina). In respect of an occurrence in April, May and November, nothing can be said for want of investigation; but the ascertained periods of occurrence go to show that the spawning is not interrupted by periods of rest or, in any case, that if such do occur they must be rather restricted.

b. PARALEPIS RISSOI KRØYERI Lütken.

Material. The portion of the material, not previously worked up, which forms the basis of this investigation consists of 386 postlarvæ (and also one adolescent individual). The majority, 356 specimens, were taken by the "Thor" mostly during the cruise in 1906. The new material contains no adult specimen but, as stated during the systematic discussion of the form, I have had an opportunity of examining a very substantial portion of the adult specimens found up to the present.

Horizontal distribution. The knowledge, up to the present, of the distribution of *P. rissoi krøyeri* is for the most part based on scattered finds of specimens along the coasts of the northerly, especially north-western, portion of the North Atlantic. Only very few of the specimens were taken alive, a large number were extracted from the stomachs of fish and seal. Specimens taken off the coast of Greenland are spoken of by several authors (Krøyer 1847, Günther 1864, Lütken 1892, Jensen 1909 (Sermiligak Fiord, N. of Angmagsalik, 1892)). Along the eastern coast of North America the form is known from St. Lawrence Bay (Gill 1864), and the "Albatross" took 8 specimens from the stomachs of fish at two stations in May 1886, at 32° 39′ N. lat., 76° 50′ and 77° 01′ W. long. respectively. From Iceland finds of only two specimens are recorded in the literature, namely one from Vestmanneyjar in 1845, the other from Faxaflói in 1880 (Sæmundsson 1926); in recent times (1930) it has, however, turned up, that the form occurs in abundance off the south-eastern coast of Iceland, where in large numbers specimens, about 20 cm. in length, were extracted from the stomachs of coalfishes (in a single one about 40 specimens were found) and cods, caught along the 200 meter isobath at the range between Berufjarðaráll and Reydarfjarðardjúp. I am indebted to Dr. B. Sæmundsson for the information of these finds and also for the admittance of verifying the determination of a great number of the found specimens. From Norway two specimens are known, namely from Sørøen, Vestfinmarken, found about 1885 (Collett 1897 and 1903) and from Smølen (Grieg 1911). Besides this Knipovich cites (1926, p. 182) the occurrence of the form along the coast of the Barents Sea (Kola Fiord).

The new material does not lend itself, in so high a degree as the number of individuals might lead one to suppose, to the elucidation of the horizontal distribution of the postlarval specimens of the form, as the majority originate from a rather limited area where the investigation, for other reasons, was carried on with particularly great intensity. This area comprises the waters to the S. W. of Ireland stretching to about 15° W. long. and also the Bay of Biscay, which was trawled through by the "Thor" in the summers of 1905 and particularly 1906. The "St. Croix" and the "Ingolf" have taken single specimens S. W. of the said area near 20° W. long., the "Margrethe", likewise, at the same longitude and 57° N. lat., the most northerly position for a find of postlarvæ. The "Dana" has taken a specimen off the coast of Portugal. From the area between about 20° and about 50° W. long. no find is forthcoming, a circumstance which is most likely due to deficient investigation, for, as pointed out during the systematic discussion of the form, samples from the eastern and the western area of occurrence do not show any assignable difference from each other. The "Margrethe" has taken the form at two stations at about 50° W. long., the "Pennsylvania" near 70° W. long. and the "Dana" near the coast of America, off Cape Hatteras.

As the north-western portion of the North Atlantic has been examined only to a small extent, one cannot form any estimate as to how near the places of occurrence, reported as most northerly, lie to the actual northern limit of the distribution of the postlarval specimens; it must, however, be mentioned, that no specimen was taken by the "Dana" in the stretch between the Faroe Islands and Cape Farewell (at the end of May and beginning of June 1925) where, at three stations between about 22° and 38° W. long., fishing was carried on with fairly great lengths of wire as well, nor was there any taken in the southern portion of the Davis Strait (June and July 1925), where at some stations, at which the depth might not have been any hindrance for the occurrence, fishing was carried on with lengths of wire up to 300 m.

As regards the determination of the southern limit, the conditions are much more favourable; but, before this is made an object of closer consideration, it will be expedient to examine the vertical distribution.

The results from the specially investigated area above referred to, afford a fairly good material for judging what significance the depth has for the limitation of the horizontal distribution of the postlarvæ. It appears, that no specimen was taken within the 200 meter isobath. A number of specimens are at hand from stations situated between the 200 and 1000 meter lines, though none was taken at a depth of less than 370 m., and — what is hardly without significance — all the 44 small specimens found, < 15 mm. in length, were taken outside the 1000 meter isobath.

Vertical distribution. In the following, a survey is given of the division of the main part of the material, among the different lengths of wire used. This portion was collected by the "Thor" in the summer of 1906. Here also each size-group is considered by itself, and each number of specimens is placed in relation to the aggregate number of hours in which fishing was carried on with the lengths of wire in question at all the stations where the subspecies was taken. The smallest size-group, specimens < 10 mm. in length, is represented by only two specimens, both taken with a length of wire of 300 m.

M. W.	25	65	100	200	250	300	400	500	600	800	1000
Number of hours	1¼	2½	8	17½	9	67	10½	3½	11	6	16
Length 10—15 mm.											
Number of specimens	..	..	..	1	..	35	2	..	..	..	..
No. of specimens div. by no. of hours	..	..	..	0.1	..	0.5	0.2	..	..	..	
Length 15—25 mm.											
Number of specimens	..	..	..	3	3	173	22	6	..	2	..
No. of specimens div. by no. of hours	..	..	..	0.2	0.3	2.6	2.1	1.7	..	0.3	..
Length 25—40 mm.											
Number of specimens	..	..	..	2	..	61	3	3	1	1	2
No. of specimens div. by no. of hours	..	..	..	0.1	..	0.9	0.3	0.9	0.1	0.2	0.1
The entire material											
Number of specimens	..	..	..	6	3	271	27	9	1	3	4
No. of specimens div. by no. of hours	..	..	..	0.3	0.3	4.0	2.6	2.6	0.1	0.5	0.3

As it will be seen, the 300 m. length of wire is the one with which the largest number of specimens has been taken per hour in all three size-groups. This is most pronounced as regards the smallest specimens, to catch which hauls with greater than 400 m. length of wire have given negative results. As regards the large specimens, it seems true that they are taken with 400 and 500 m.w. only in somewhat smaller numbers than with 300 m.w. On the other hand, the catches with still larger lengths of wire are so insignificant that it is possible the few specimens originate from less depths than those corresponding to the lengths of wire, and have been caught when the apparatus was being hauled in. The hauls with 200 (and 250) m.w. have given a catch of a similarly small size; the very low proportional figure can hardly have occurred by accident, as fishing with the length of wire in question was carried on for more hours than with 400 and 500 m.w. taken together. Likewise, the completely negative result of the hauls with lengths of wire less than 200 m. ought to be an expression of the reality, as the aggregate number of hours, for instance, exceeds the time during which fishing with 400 m.w. was carried on.

A similar state of things is shown by the material from the cruise of the "Thor" in the summer of 1905 and those from the "Margrethe" and the "Dana"; no haul with a wire of a length less than

300 m. has given a positive result, though several hauls with smaller lengths of wire have been made at all the stations positive for the form.

On the other hand, the distribution of the specimens taken by the "Thor" at the stations 74—76 on the 9th and 10th of March 1909 has a somewhat different appearance:—

	M. W. 25	65	300	600	1600
Number of specimens	1	5	8	1	1

as the "St. Croix" and the "Ingolf" specimens were taken with a length of wire less than 100 m. on the 6th and 7th of March.

These facts can hardly be explained in any other way than, that the time of the year has an influence on the vertical distribution of the postlarvæ just as it has as regards the other form. The material of the "Thor" from 1905 was taken between the 14th and 24th of June, from 1906 between the 10th of May and the 16th of June and between the 26th of August and the 10th of September. It might be objected that the temperature, the factor which comes particularly into consideration in this connection, is about the same in May, from which a large part of the material originates, as in March, a fact that also appears from the surface observations of the "Thor" which, at the stations in May 1906, show the temperatures 11°.34—11°.71 (a single 13°.0), at the stations 74—76 in March 1909, which have about the same position, show 10°.78—11°.5. In May, however, no hauls were made with fairly small lengths of wire, except a single one with 250 and a single one with 200 m.w., 100 m.w. was not used until after the 10th of June.

The material derived from the winter months is unfortunately very limited in extent, but seems, however, sufficiently large to show, that postlarvæ, at that time of the year, are, without any great difference, found in depths corresponding to 65 and to 300 m.w., while no specimen of the fairly large summer material was found to exist at a depth less than that corresponding to 200 m.w., and but few at a depth less than that corresponding to 300 m.w. One must therefore, as in the case of the southerly form, assume the presence of a certain connection between a temperature maximum and the vertical occurrence of the postlarvæ, especially of the smallest one. In any case, the difference found in respect of the vertical occurrence at different times of the year agrees exceedingly well with the conditions of temperature.

At the aforementioned stations 74—76 in 1909 the following temperatures were observed:—

Depth in meters	St. 74	St. 75	St. 76
0	11°.50	11°.40	10°.78
100	11°.55	11°.27	10°.81
200	11°.54	11°.29	10°.78

which means, that the temperature is practically the same from the surface to a depth of 200 meters, while temperatures observed at a station, as for instance St. 190 on the 11th of September 1906 at about the same position, 46°30′ N. lat., 7°00′ W. long., as St. 75 in 1909, are as follows:—

0 m. — 18°.82, 25 m. — 17°.82, 50 m. — 15°.16, 100 m. — 11°.74, 200 m. — 11°.05.

Thus we find, at depths of 100 and 200 m., similar temperatures to those shown above at the three stations in March 1909.

Even though, as stated, the proportion between a depth and a length of wire can only very approximately be reckoned to be as 1 to 2, it will, however, be perceived, that individuals taken near the surface, as well as with a 300 m. length of wire, in March were, as far as the temperature is concerned, taken under about the same conditions as individuals taken with 300 m.w. in September.

Relation between vertical and horizontal distribution. As previously mentioned, only the southerly limit of the horizonal distribution of the postlarvæ can, owing to deficient investigation, be

fairly well determined, so that only the relation between this and the vertical occurrence of the postlarvæ during the hot season can be considered more fully. Unfortunately, the material taken during the hot months is lacking in the smallest specimens (< 10 mm.), one is therefore under the necessity of examining the relation between the vertical distribution of specimens next in size (10—15 mm.) and the southerly limitation of the distribution of the postlarvæ. As specimens, 10—15 mm. in length, were, for the most part, taken with 300 m.w., the chart Fig. 26 (p. 105), which shows the distribution of the postlarvæ found, is marked with isotherms as (according to SCHOTT 1902) they prevail at a depth of 150 m. As will be seen, there seems to be a good agreement between the southern limit and the course of the isotherms, and this limit seems to lie near the 13°- isotherm. It is certainly reasonable to assume that the smallest specimens, as is the case with regard to the other form, occur, for the most part, somewhat deeper than the specimens 10—15 mm. in length, so that it should be the isotherms at a depth of 200 meters that should be taken into consideration. In the area of distribution found, the courses of the isotherms at the two depths differ, however, very little from each other.

Propagation. Small postlarval specimens, < 15 mm. in length, were found in March, May, June, August and September. In the months of October—February and also in April, investigations have not been undertaken by sea research vessels within the distribution limits found. Thus it is not possible, on a basis of the material at hand, to determine whether the form has any restricted spawning period. The occurrence of small postlarvæ at such different times of the year as those mentioned, goes to show that this is not the case.

2. PARALEPIS COREGONOIDES Risso.

a. PARALEPIS COREGONOIDES COREGONOIDES Risso.

Material. The material which forms the basis of this investigation consists of 636 postlarval specimens, of which 362 are derived from the Mediterranean cruises of the "Thor", 14 from the supplementary investigation of the Straits of Messina, while 260 have been taken in the Alboran Sea and the Balearic Sea, — and also one adolescent specimen (Messina).

Horizontal distribution. The species is first known from Nice (RISSO 1810 and 1826, CUV. and VAL. 1831). The finds mentioned in the literature on the subject, at other localities, consist only of a few specimens. In 1879 a specimen was found by Cornigliano near Genoa, in 1882 a single specimen, likewise, was taken by the R/S "Washington" in the middle of the waters between Sardinia and Sicily; a specimen is known from Palermo, found by BELLOTTI (VINCIGUERRA 1885). Furthermore Prince ALBERT of Monaco reports the catch of a specimen, determined by FOL and de GUERNE, off Monaco (1890).

The horizontal distribution of the postlarvæ is, on broad lines, the same as found in the case of *P. rissoi rissoi* in the Mediterranean (see Fig. 27, p. 115). The postlarval specimens, like those of that form, were found rather evenly distributed over the greater portion of the Mediterranean, the parts excepted are, the Ægean Sea, the area between the sout-western coast of Sicily and Africa and also the large portion of the Catalonian Sea, which lies within the 1000 meter isobath. Within this limit are also the two other areas, a circumstance, as mentioned, which may perhaps explain the lack of occurrence. The form does, however, appear to have a slightly more restricted distribution than *P. rissoi rissoi*. The common occurrence thus ceases westward in the middle of the Alboran Sea, only a single specimen having been taken near Gibraltar, while *P. rissoi rissoi* is equally well represented at the "Thor" stations in the western Alboran Sea as at those in most of the other parts of the Mediterranean; likewise, the northern limit for the occurrence of

postlarvæ appears to lie in the southern portion of the Ligurian Sea, while postlarvæ of *P. rissoi rissoi* were found almost up to the inner limit of the Gulf of Genoa.

Vertical distribution. The above mentioned specimen taken off Monaco, was caught in a net 1200 m. below the surface and 300 m. above the bottom, but otherwise no other information is forthcoming as regards the adult specimens.

The following synopsis includes the material of the postlarval specimens collected by the "Thor"; the material is treated in the same way as the corresponding material of *P. rissoi rissoi.*

	M.W. 25	65	100	150	200	300	400	600	1000	>1000
Winter Number of hours	15	21½	2	3½	4½	19½	½	4½	9	..
Summer do.	9	2¼	0	0	0	11 7/12	0	1½	8¼	7¾
Length < 10 mm.										
Winter Number of specimens	33	7	..	..	..	1	..	..	..	..
No. of specimens div. by no. of hours	2.2	0.3	..	..	..	0.1	..	..	..	..
Summer Number of specimens	..	..	..	..	..	2	..	..	..	..
Length 10—15 mm.										
Winter Number of specimens	31	44	..	..	2	1	..	2	..	..
No. of specimens div. by no. of hours	2.1	2.0	..	..	0.4	0.1	..	0.4	..	..
Summer Number of specimens	..	11	..	..	..	46	..	4	8	1
No. of specimens div. by no. of hours	..	4.9	..	..	..	4.0	..	2.7	1.0	0.1
Length 15—25 mm.										
Winter Number of specimens	11	43	1	..	1	27	..	4	1	1
No. of specimens div. by no. of hours	0.7	2.0	0.5	..	0.2	1.4	..	0.9	0.1	..
Summer Number of specimens	2	1	..	..	..	61	..	4	7	4
No. of specimens div. by no. of hours	0.2	0.4	..	..	..	5.3	..	2.7	0.8	0.5
Length > 25 mm.										
Winter Number of specimens	..	..	..	..	..	..	..	1	..	..
The entire material										
Winter Number of specimens	75	94	1	..	3	29	..	7	1	1
No. of specimens div. by no. of hours	5.0	4.4	0.5	..	0.7	1.5	..	1.6	0.1	..
Summer Number of specimens	2	12	..	..	..	109	..	8	15	5
No. of specimens div. by no. of hours	0.2	5.3	..	..	..	9.4	..	5.3	1.8	0.6

The distribution, as regards the different lengths of wire, of the material collected by the "Dana" in the Alboran Sea and the south-western part of the Balearic Sea at the end of September and the beginning of October 1921, is as follows:—

	M.W. 25	50	100	150	200	250	300	400	500
Number of hours	2½	6½	17	14½	19	9½	13½	4	1
Length < 10 mm.									
Number of specimens	..	..	..	..	2	2	29	36	2
No. of specimens div. by no. of hours	..	..	..	..	0.1	0.2	2.1	9.0	2.0

M.W.	25	50	100	150	200	250	300	400	500
Length 10—15 mm.									
Number of specimens	..	..	..	..	9	3	83	35	11
No. of specimens div. by no. of hours	..	..	..	..	0.5	0.3	6.1	8.8	11.0
Length 15—25 mm.									
Number of specimens	..	..	..	..	3	1	34	4	6
No. of specimens div. by no. of hours	..	..	..	..	0.2	0.1	2.5	1.0	6.0
The entire material									
Number of specimens	..	..	..	..	14	6	146	75	19
No. of specimens div. by no. of hours	..	..	..	..	0.7	0.6	10.8	18.8	19.0

To judge of the relation between winter and summer, in respect of the vertical distribution, it ought to be possible to use the material of the "Thor" for a direct comparison, the method of working having been the same on both cruises. As already mentioned, the "Thor" material, however, suffers from the defect that the different lengths of wire have been used to a rather different extent winter and summer, whereby values, in other respects comparable, become more or less representative. Of the smaller lengths of wire, however, 25 m.w. and 300 m.w. have on both cruises been used in a rather high degree, so that the material derived from the catches made with these lengths of wire enables us to judge of the relation between the corresponding depths. On the other hand a 65 m. length of wire was, during the summer cruise, used only about a tenth of the time it was employed on the winter cruise, and the 100, 150 and 200 m. lengths were not used at all on the summer cruise.

Of the smallest postlarvæ (< 10 mm.), the "Thor" took only two specimens during the summer, but the scanty catch, however, shows, as far as the length of wire is concerned, conditions different from those under which the specimens from the winter cruise were taken, as only one of these 41 specimens was taken with the same length of wire, 300 m., while the majority derive from catches made with 25 m.w. A corresponding distribution will be seen of specimens 10—15 mm. long. in winter, only with the difference that the catches with 25 and 65 m.w. are equally large. In summer these sizes also seem to be lacking in the uppermost layers of water, as no specimens have been taken with 25 m.w., whereas it was not necessary to use greater length of wire than 65 m. to make a catch. Whether the proportional figure found for the catch with 65 m.w., which is larger than that with 300 m.w., is representative, is certainly very doubtful, owing, as stated above, to that length of wire not having been so much used. As a difference from the state of things with the smallest postlarvæ, a portion of the material was also taken with greater lengths of wire, particularly on the summer cruise. The next size-group shows a distinct shifting downwards in respect of the number of specimens. The summer material, however, also shows an extension of the vertical distribution upwards, as it contains two specimens taken with 25 m.w.

The supplementary material, which was taken by the "Dana" at the end of September and the beginning of October and thus is fairly suitable, as regards the season, for comparison with the material from the summer cruise of the "Thor", agrees with the latter in that respect, that the catch was made, for the most part, by the use of the greater lengths of wire, whereas one might — in spite of the different proportion between the length of wire and the depth — also have expected a catch with a somewhat smaller length of wire than 200 m.

As regards the vertical distribution of the postlarval specimens, matters are, to a certain degree, the same as with *P. rissoi rissoi*. In the case of both, the use of 25 m.w. during the summer has given no catch, or, in proportion to the aggregate number of specimens, quite an insignificant one, of the smallest and fairly small sizes (up to 15 mm.), while the material from the winter cruise does not point to such a deficient, or very scanty, occurrence of the same sizes in the superficial layers of water, at that

time of the year. In other respects, however, the two forms differ considerably from each other, as will immediately be seen from the below given arrangement of previously mentioned figures, the result of the examination of the material collected by the "Thor" in the Mediterranean. Where nothing else is stated, the figures indicate the proportion between the number of specimens and the number of hours.

		Winter		
	M. W.	25	65	300
Length < 10 mm.	*P. coregon. coregon.*	2.2	0.3	0.1
	P. rissoi rissoi	1	1	3 specimens.
» 10—15 »	*P. coregon. coregon.*	2.1	2.0	0.1
	P. rissoi rissoi	0.3	0.9	0.6
» 15—25 »	*P. coregon. coregon.*	0.7	2.0	1.4
	P. rissoi rissoi	0.2	0.4	1.8

		Summer		
	M. W.	25	65	300
» < 10 »	*P. coregon. coregon.*	..	..	2 specimens.
	P. rissoi rissoi	..	..	11 —
» 10—15 »	*P. coregon. coregon.*	0	4.9	4.0
	P. rissoi rissoi	0.1	0	5.6
» 15—25 »	*P. coregon. coregon.*	0.2	0.4	5.3
	P. rissoi rissoi	0.1	0	4.7

As will be seen, the winter material shows a considerable difference between the two forms, particularly as regards the two smallest size-groups. While the catch of *P. rissoi rissoi* seems somewhat independent of whichever of the three lengths of wire in question is used, yet with a suggestion that the use of 25 m.w. gives fewer specimens than that of 65 and 300 m.w., the catch of *P. coregon. coregon.*, as regards the smallest size-group (< 10 mm.), is, to a paramount degree, connected with the use of 25 m.w., being far less with 65 m.w. and insignificant with 300 m.w. Of the 10—15 mm. long specimens of *P. coregon. coregon.*, the same number per hour was taken with 65 m.w. as with 25 m.w., while the catch with 300 m.w. is just as small as in the case of the smallest specimens. In respect of the specimens 15—25 mm. in length, the catch of *P. coregon. coregon.* is fairly evenly distributed among the three lengths of wire, while of the other form by far the largest number of specimens was taken with 300 m.w.

The summer material, as stated, showed an agreement between the two forms in respect of the deficient, or extremely scanty, catch of the smallest specimens with 25 m.w., whereas the use of 65 m.w, gave different results. With this length of wire, not a single specimen of *P. rissoi rissoi*, measuring less than 25 mm., was taken, while as regards the other form, the number of specimens measuring from 10 to 15 mm. is apparently (the figure is hardly representative) larger than that of the same size taken with 300 m.w.

One might perhaps *a priori* think that such a difference might possibly be due to a dissimilar division, as to time, of day and night hauls made with the length of wire in question. That this, however, cannot be the case, will be perceived when it is stated that, of the 14 hours, during which the 65 m.w. was used on the winter cruise at stations positive for the catch of *P. rissoi rissoi*, three were during the day, and of the $21^1/_2$ hours, during which the same length of wire was used at stations positive for the catch of *P. coregon. coregon.*, seven were during the day.

Besides, it seems that, on the whole, the difference between day and night is not of any great importance for the catch of the postlarval specimens of these fishes, as it *inter alia* is illustrated by the

fact that the 33 %, which the seven hours during the day amount to, of the entire time the 65 m.w. was used at stations positive for *P. coregon. coregon.*, nearly correspond to the portion, which the number of specimens of this form taken during the day with the same length of wire amounts to of the total number, namely 28 %.

The difference found between the two forms which must consequently be considered a reality, is mainly to be explained by a different adjustment as to the temperature. In the case of both forms it seems that the common occurrence of the youngest postlarval specimens is determined by rather restricted limits of temperature, of which the upper corresponds, approximately, to the summer temperature of the uppermost layers of water in which these specimens occur at that time of the year.

The material of the smallest specimens (< 10 mm.) does not point to any difference between the two forms in respect of the vertical occurrence. As the material, however, is extremely scanty, consideration must be taken as to how matters stand with the specimens next in size (10—15 mm.). The aforementioned difference in these sizes suggests, that the upper limit of temperature for the common occurrence of the smallest specimens lies somewhat higher in *P. coregon. coregon.* than in *P. rissoi rissoi.* That this limit of temperature lies higher in *P. coregon. coregon.* seems also to appear from the particular occurrence in winter of the smallest and fairly small postlarval specimens of this form, concentrated as it is in the upper layers of water, the majority having been taken only as far down as a depth corresponding to 65 m.w. These layers of water, to wit at most of the localities where the specimens in question were taken, have in most cases even in the winter months, in which observations were made, a higher temperature than the deeper layers, as will appear from the following results:—

Depth in meters	10	25	50	150
St. 11	16°.62	16°.62	16°.62	14°.45
» 15	15°.43	15°.41	15°.21	14°.25
» 24	14°.20	14°.10	14°.02	13°.62
» 30	13°.68	13°.69	13°.71	13°.81
» 39	13°.26	13°.26	13°.27	13°.81
» 43	13°.97	13°.97	13°.98	13°.44
» 46	14°.29	14°.30	14°.40	14°.03

It will, however, be seen that the conditions of temperature alone do not suffice to explain the peculiar concentrated occurrence of this form near the surface in the winter. Thus they do not account for the great difference between the numbers of the smallest specimens (< 10 mm.) taken with 25 and 65 m.w. respectively, as the temperature at the corresponding depths is about the same. One is, then, obliged to think that the vertical occurrence of the youngest postlarval specimens of this form is also determined by another factor which, in winter, apparently acts undisturbed, as the temperatures which at that time of the year prevail at the depths in question are equal to, or lie near, the optimum for the occurrence of the youngest postlarvæ, whereas in summer the predominance of the factor of temperature asserts itself obviously.

Relation between vertical and horizontal distribution. The vertical distribution described above may in a similar manner, as in the case of *P. rissoi rissoi*, explain that the postlarvæ, in spite of the restricted limits of temperature which seem to determine the occurrence of the youngest specimens, may be met with over the greater portion of the Mediterranean, both summer and winter. In agreement with the fact, that the upper limit of temperature for the common occurrence of the youngest postlarvæ seems to lie higher as to *P. coregon. coregon.* than as to *P. rissoi rissoi*, is perhaps the difference pointed out between the two forms in respect of the horizontal occurrence in the Ligurian Sea, to wit that the winter temperature at the northern limit found, in that area, for the distribution of the postlarvæ of *P. coregon.*

coregon. may lie near the minimum for the occurrence of the youngest postlarval specimens, while the distribution of the postlarvæ of *P. rissoi rissoi* may be restricted only by a somewhat lower temperature.

Propagation. Small postlarval specimens, < 15 mm. in length, were found in the months of December to March and June to October. On account of deficient investigation nothing can be said as to a possible occurrence in April, May and November. As in the case of *P. rissoi rissoi,* the ascertained periods of occurrence practically imply that spawning takes place continually all the year round.

b. PARALEPIS COREGONOIDES BOREALIS Reinhardt.

Material. The previously unexamined portion of the material that forms the basis of this investigation, includes 1264 postlarval (and also one adolescent) specimens. The main portion, 1187 specimens, were taken by the R/S "Dana" in 1921—22. As in the case of *P. rissoi krøyeri* I have had an opportunity of examining a fairly substantial number of the previously found adult specimens.

Horizontal distribution. The hitherto certain knowledge of the geographical distribution of Reinhardt's *Paralepis*-form, like a similar knowledge of the other northern form, is based on scattered coastal finds of adult specimens. The form is first known from South Greenland where it was taken at Julianehaab in 1830 and at Frederikshaab in 1831 (Reinhardt 1830—31 and 1838). Later on several others were added to these two specimens, as mentioned by Lütken (1892). From Iceland, the first find is recorded in 1833 in the neighbourhood of Reykjavik (Reinhardt 1838), later on, scattered finds from the west and south coasts; in 1884 a specimen was found in Skerjafjörður near Reykjavik (Grøndal 1891), in 1913 one at Vestmanneyjar, in 1920 one in Hornafjörður, furthermore a find is recorded in Faxaflói in 1899 (Sæmundsson 1908, 1926 and 1927 a). A single specimen is known from the British Isles, *viz.* the one described by Day as *P. coregonoides* which in 1869 was driven ashore on the coast of Cornwall (Day 1880—84). From Norway there is, likewise, recorded only a single find of a specimen which, in 1923, was stranded in the neighbourhood of the town Namsos, at about 64° N. lat. (Nordgård 1924).

No adult specimen has with certainty, up to the present, appeared off the American coast; as more fully argued in the systematical part of this work, it is fairly probable that the specimen from Cape May County, New Jersey, described by Fowler and Phillips as the type of a new species, *P. barracudina,* is specifically identical with *P. coregon. borealis.*

Likewise, as stated, it is very probable that the postlarvæ from the Bay of Biscay described by Holt and Byrne under the designation "Long-anal Larva" and "*Paralepis* sp." belong to that form.

In respect of the main material which forms the basis of this investigation, *viz.* the large number of postlarvæ, a similar state of things to that in the case of *P. rissoi krøyeri* exists, namely that the different areas within the range of the distribution are far from having been investigated with equal thoroughness, so that a distinction must be made between the well investigated eastern area (east of about 30° W. long.) and a less thoroughly investigated western area. In addition to this, the northern limit, particularly of the western area, cannot even be considered approximately determined by the most northerly occurrences found, as so few observations are available from the large area which lies north and north-west of the limit found. It must, however, be stated that during the cruise of the "Margrethe" from the Faroe Islands to the Azores, on which stretch twelve stations were taken, the form was not found, except at the most southern station near the Azores; furthermore are to be put in mind the researches made by the "Dana" in May and June 1925, between the Faroe Islands and Cape Farewell, and also in the southern portion of the Davis Strait in June and July 1925, during which, as mentioned when discussing *P. rissoi krøyeri,* the depth conditions and the use of wire lengths, in the case of several stations, were not able

to explain the negative result, with regard to the taking of postlarvæ, which prevails in the case of this form as well.

The above mentioned more thoroughly investigated eastern area of the range of distribution of the postlarvæ is divided again into two parts, a northerly, referred to when discussing *P. rissoi krøyeri* (the Bay of Biscay and the waters south-west of Ireland) and a southerly which embraces the Bay of Cadiz and the adjacent portion of the Atlantic, bounded to the south and west by about the latitude and longitude of Madeira, and the waters adjacent to the Azores. Consequently the range of distribution stretches

Fig. 27. Distribution of the postlarvæ of: ● *Paralepis coregonoides coregonoides* Risso and ○ *Paralepis coregonoides borealis* Reinhardt. The isotherms at a depth of 150 meters are indicated (after Schott 1902).

further south than that of the other northern form. In accordance herewith this fact seems to be that, while far the greater number of the postlarvæ of *P. rissoi krøyeri*, more than 300 specimens, were taken in the above mentioned northerly part of the eastern area, only 22 specimens of *P. coregon. borealis* have been taken there, while the majority of the, about, 1200 postlarvæ were taken in the southerly area between Gibraltar and Madeira.

It is thus possible that the scanty catch in the Bay of Biscay and the waters south-west of Ireland demonstrates that that area lies closer to the actual northern limit for the occurrence of postlarvæ of *P. coregon. borealis* than for that of *P. rissoi krøyeri*. Against the likelihood of such an assumption, it might be urged that the southern limit lies near the said area (the Bay of Cadiz and the adjacent portion of the Atlantic) which has given the large number, as towards the south only a single specimen has been

taken outside of that area, at 29½° N. lat. Matters in that respect are, however, not so different from what we found as to *P. rissoi krøyeri*, for which form the most southerly found occurrence in the eastern area was also not far from the region which, as regards that form, gave the large number of postlarvæ.

West of the Azores the investigation was carried on only to a minor extent in the latitudes which are here taken into consideration. The catch of postlarvæ is in fact numerically insignificant; from the large area between the Azores and 60° W. long. not a single specimen is forthcoming; at about 60° and about 70° W. long., the S/S. "Pennsylvania" has taken three specimens and the "Dana" a single specimen near the coast of America at St. 1349, the one situated nearest to the mainland of the very important series of stations which the "Dana" took between Bermuda and Cape Hatteras.

As mentioned, it has been possible to determine the number of myomeres in two of the "Pennsylvania" specimens which two figures do not suggest any divergence from the specimens in the easterly area. The agreement, in that respect, between specimens from the northerly area south-west of Ireland and the southerly from St. 1141 near Madeira, from three stations in the Bay of Cadiz and from St. 1012 at the Azores, is likewise mentioned. The stations named are those that have been able to furnish material for this investigation. Specimens from other stations have not been sufficiently developed to admit of the number of myomeres being determined with certainty. It must then, in this connection, be remembered that the postlarval specimens of the closely related forms *P. coregon. coregon.* and *P. coregon. borealis* resemble each other to such a degree that a positive determination can hardly be arrived at except by means of the number of myomeres or the number of vertebræ. When all available lots of material for such an investigation give figures which do not imply an intermixture of *P. coregon. coregon.*, one may conclude that an occurrence of this form outside the Mediterranean, if this should happen, must be relatively rare.

Vertical distribution. When making use of the material for the investigation of the vertical occurrence of the postlarvæ one is, in accordance with what has been stated above regarding this form, in a situation of not being certain that one is working with pure material. As a possible intermixture of specimens of *P. coregon. coregon.* must, however, in any case be assumed to be relatively small, and the condition of this form, in respect of the vertical distribution, does not differ much from that of *P. coregon. borealis*, the results produced will, at the worst, be only slightly misleading.

The following synopsis shows a division of the main material among the different lengths of wire with which it was taken. It represents the specimens taken by the "Dana" from the easterly area (St. 1103—13 and 1139—41). The treatment of the material is the same as of that of the aforementioned forms, and the numbers of hours given indicate the aggregate of the hours in which the respective lengths of wire have been used at the stations where the form was taken.

M. W.	25	50	100	200	300	400	500	600
Number of hours	6	18¼	29¾	29¼	29¼	15¼	7	2
Length < 8 mm.								
Number of specimens	..	..	..	11	93	31	35	..
No. of specimens div. by no. of hours	..	..	..	0.4	3.2	2.0	5.0	..
Length < 10 mm.								
Number of specimens	..	..	..	50	202	75	94	13
No. of specimens div. by no. of hours	..	..	..	1.7	6.9	4.9	13.4	6.5
Lenght 10—15 mm.								
Number of specimens	..	..	5	71	204	47	47	..
No. of specimens div. by no. of hours	..	..	0.2	2.4	7.0	3.1	6.7	..

Length 15—25 mm.	M. W. 25	50	100	200	300	400	500	600
Number of specimens	..	..	6	18	27	24	23	..
No. of specimens div. by no. of hours	..	..	0.2	0.6	0.9	1.6	3.3	..

It is true of all sizes that the larger catches are connected with the use of lengths of wire of 300 m. and more, while no specimens have been taken with the small lengths, 25 and 50 m. For catches with the intervening lengths there is apparently a difference to be seen in respect of the size of the post-larvæ. Of specimens less than 8 mm., the number per hour taken with 200 m.w. is small compared with the number derived from catches with 300 m.w., and distinctly smaller than the corresponding number of specimens less than 10 mm., while 100 m.w. has not given any specimen of the sizes considered. Within the two other size-groups the use of 100 m.w. has given results, comparatively small, of specimens 10—15 mm. in length, larger, of specimens 15—25 mm. in length. In accordance herewith a corresponding increase of the catch with 200 m.w. is to be seen.

The above mentioned portion of the material was collected from the 9th of September to the 14th of October. The remaining smaller portion was taken during six different months, so that material taken within a limited period, suitable for direct comparison with the above, is not forthcoming; the smallest specimens in particular are lacking, there being, on the whole, only two less than 10 mm. in length. Some information, however, can be gleaned. Thus, we find that specimens derived from March and April, a time of year diametrically opposite to the period in which the collection of the main material was made, and, as far as the temperature is concerned, very different from it, were, likewise, for the most part, taken with lengths of wire greater than 100 m., but yet, on the other hand, in the case of single specimens, with a length which demonstrates the possibility of catches in the superficial layers as well. Thus, a specimen was taken by the M/S "Dana" at St. 827 with 10 m.w. and the schooner "Anne" (St. 358) took a specimen with 38 m.w. Other instances of a positive result from the use of smaller lengths of wire date from the 26th of October and the 23rd of November, with the use of 56 and 34 m.w. respectively; the first, the catch of a single specimen, was made at a time of the year but little later than that at which the main material was taken; but the 56 m.w., most likely, indicates a greater depth than the same length of wire used by the "Dana".

Relation between vertical and horizontal distribution. For an investigation of the relation between the vertical distribution of the smallest postlarvæ and the horizontal distribution of the postlarvæ in general, one has to depend on the large material, the result of the collections made by the "Dana" in the easterly area. The opening date of the catch in this area, the 9th of September, lies close to the hottest month of the year, August; the entire material will thus fairly well illustrate the state of things in summer. The large number of the smallest specimens, less than 8 mm., were taken with lengths of wire from 300 to 500 m. If one reckons the proportion between the length of wire and the depth at approximately 3 to 1, the occurrence of the tiny postlarvæ will thus be at a depth of about 133 m. or, in round numbers, 150 m. On the chart Fig. 27 (p. 115), which shows the distribution of the postlarvæ, isotherms are (according to SCHOTT) noted at this depth. There seems to be a parallelism between the southerly limit of the area of distribution and the lines of the isotherms. It will be seen, that the southern limit, looked at apart from the catch of a single fairly large specimen at about $29^1/_2°$ N.lat., coincides very nearly with the 16°- isotherm. In contrast to the northern limit, the southern one can be regarded as a reality, as the contiguous areas which yield negative results, regarding catches of this form, have been well investigated, particularly that towards the east.

Propagation. Small postlarval specimens, < 15 mm. in length, were found in the months of June to November, also in April. Whether the circumstance that four of the remaining negative months

are consecutive indicates a cessation in the spawning, cannot be settled; apart from the few stations which the "Thor" took on the way to the Mediterranean in December 1908, no work has been done by real research vessels in the said months, within the ascertained limits of the area of distribution.

3. PARALEPIS SPECIOSUS Bellotti.

The material which forms the basis of this investigation is very scanty as regards this species, consisting altogether of 23, for the greater part, postlarval specimens. A biological investigation is thereby practically debarred. Yet the material contributes something to the extension of our knowledge of the geographical distribution of the species.

The species is first known from Nice (Bellotti 1877) and was later on found at Messina (Bellotti 1891:— "Specie rarissima a Nizza, meno rara a Messina"). During the researches made by the

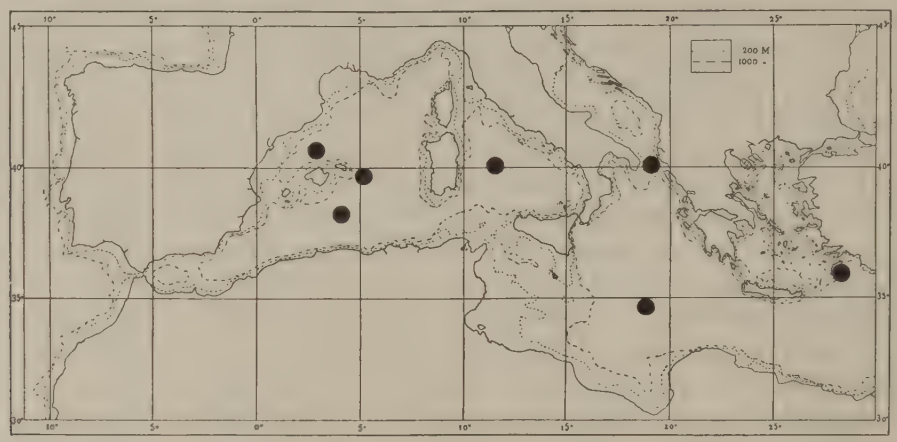

Fig. 28. *Paralepis speciosus* Bellotti. The stations of the "Thor", at which the specimens were taken.

yacht "Puritan" in the waters around Capri and at other localities in the Mediterranean, two specimens were found off Punta Carena, in the neighbourhood of Naples and two near Salina, one of the Lipari Isles (Lo Bianco 1903—04). The Monaco yacht "Princesse-Alice" in 1908 took one specimen south of the Balearic Isles, as well as two of the other specimens which, like this one, are described as "*Omosudis elongatus* Brauer" (Zugmayer 1911), but which I have not had an opportunity to examine, belong, almost certainly, to this species; one was taken in 1905, north of the Balearic Isles, the other in 1909 in the Alboran Sea. The "Najade" found two specimens in the southerly Adriatic (Pietschmann 1914).

Most of the specimens of the "Thor" were taken in the western basin, eleven at a single station in the Catalonian Sea, eight at two stations east and south-east of the Balearic Isles; one specimen was taken in the middle of the Tyrrhenian Sea, one in the Straits of Otranto, one in the southerly portion of the Ionian Sea and, finally, one in the vicinity of Rhodes. As will be seen, most of these were taken at stations situated outside the 2000 meter isobath.

The specimens of the "Puritan" (27—58 mm. in length) were caught by using lengths of wire from 1700 to 2500 m. The specimens mentioned by Zugmayer, the largest of which measured 26 mm., were caught between the surface and depths of from 1500 to 2595 m.

The material of the "Thor" is but little suitable as to elucidate the vertical distribution of the postlarvæ and its relation to the horizontal, especially as the youngest postlarval stages are not represented.

The smallest specimen, 16,5 mm. in length, was, together with several larger ones, taken with 300 m.w., while for the other positive hauls, lengths of 1000 m. and more were used.

The species has not been found outside the Mediterranean. The restricted knowledge of the vertical distribution of the postlarvæ does not admit of our understanding this lack of occurrence, which, however, may possibly be due to the pronounced contrast that exists between the Mediterranean and the Atlantic, in respect of the temperature at the greater depths.

With the exception of a single specimen taken at the end of December, the material is derived from the summer cruise of the "Thor", collected from the end of June to the end of August.

4. PARALEPIS BREVIS Zugmayer.

Material. The main portion of the material which forms the basis of this investigation comprises 398 specimens which, with the exception of a few adolescent specimens, are postlarvæ. Of these the "Margrethe" took four, the M/S "Dana" eleven, while the remainder were collected during the cruise of the R/S "Dana" in 1921—22. Besides these I have had an opportunity to examine all the adult specimens found.

Horizontal distribution. The first known specimen of this species was, in 1862, found at Madeira (described by Johnson as "*P. coregonoides*", 1862). The next, positively determined, specimen was taken in 1885 by the "Albatross" in the north-eastern portion of the Gulf of Mexico at 28° 43′ N. lat., 87° 14′ W. long. (described by Goode and Bean as "*P. coregonoides*", 1895). After this, in 1900, follows a find off the south-west coast of Iceland at Grafarvogur near Reykjavik (reported by Sæmundsson as "*P. borealis*" 1908, 1926, 1927 a and 1927 b.) In 1904 the Monaco yacht "Princesse-Alice" took two postlarval specimens at 32° 18′ N. lat. and 23° 58′ W. long. (described by Zugmayer as "*Omosudis elongatus*", 1911) and two, also postlarval, specimens, at 27° 43′ N. lat., 18° 28′ W. long. and at 36° 46′ N. lat., 26° 41′ W. long. respectively (described by Roule and Angel as "*P. coregonoides*", 1930); in 1910 an adult specimen at 37° 10′ N. lat., 11° 48′ W. long. (described by Zugmayer as *P. brevis*, 1911) and in 1914 an adolescent specimen at 42° 18′ N. lat., 12° 08′ W. long. (described by Roule and Angel as "*P. coregonoides*", 1930). In 1925 yet another specimen was found off the coast of Iceland, *viz.* in Breiðavik, on the north-western coast (referred by Sæmundsson to "*P. borealis*", 1927 b). Finally, there is a find in 1926 from the southerly Skager Rack, 15′ north-west of Skagen (the find of this specimen, which is kept at Göteborg Naturhistoriska Museum, has not previously been published).

As the chart, Fig. 29, shows, the main distribution of the postlarvæ lies in a belt stretching over the greater portion of the width of the ocean, but seems to be limited by lines which intersect the lines of latitude at fairly large angles, as the easterly places of occurrence lie more to the south, approximately between 18° and 32° N. lat., than the westerly. The most westerly portion of the area has not been very well investigated as regards the depths taken into consideration here; but, on the other hand, the area between 50° and 65° W. long. south of about 30° N. lat. has been very thoroughly investigated, so that, in any case, one can so far to the west get a good idea as to the position of the southern limit which is at about 27° N. lat. The material does not make it possible to determine a corresponding northern limit; but it must be remarked that the species at 47° W. long. was taken as far north as at 28° N. lat. In addition to the main distribution, there is a more local occurrence around the northern portion of the Antilles. There must, finally, be mentioned the catch of three specimens at a station off the entrance to the Bay of Cadiz. This isolated instance, in an area which is one of the best investigated, must be considered an exception that proves the rule, that the northerly limit of the distribution, eastward, lies at about 32° N. lat. In order to understand how the whole matter stands, especially the isolated occurrence around the Antilles, it will, however, be necessary first to consider the vertical distribution.

Vertical distribution. Below is a synopsis showing how the catches of the main material of postlarval specimens, namely that collected by the "Dana" in 1921—22, are distributed in respect of the different lengths of wire with which the specimens were taken:—

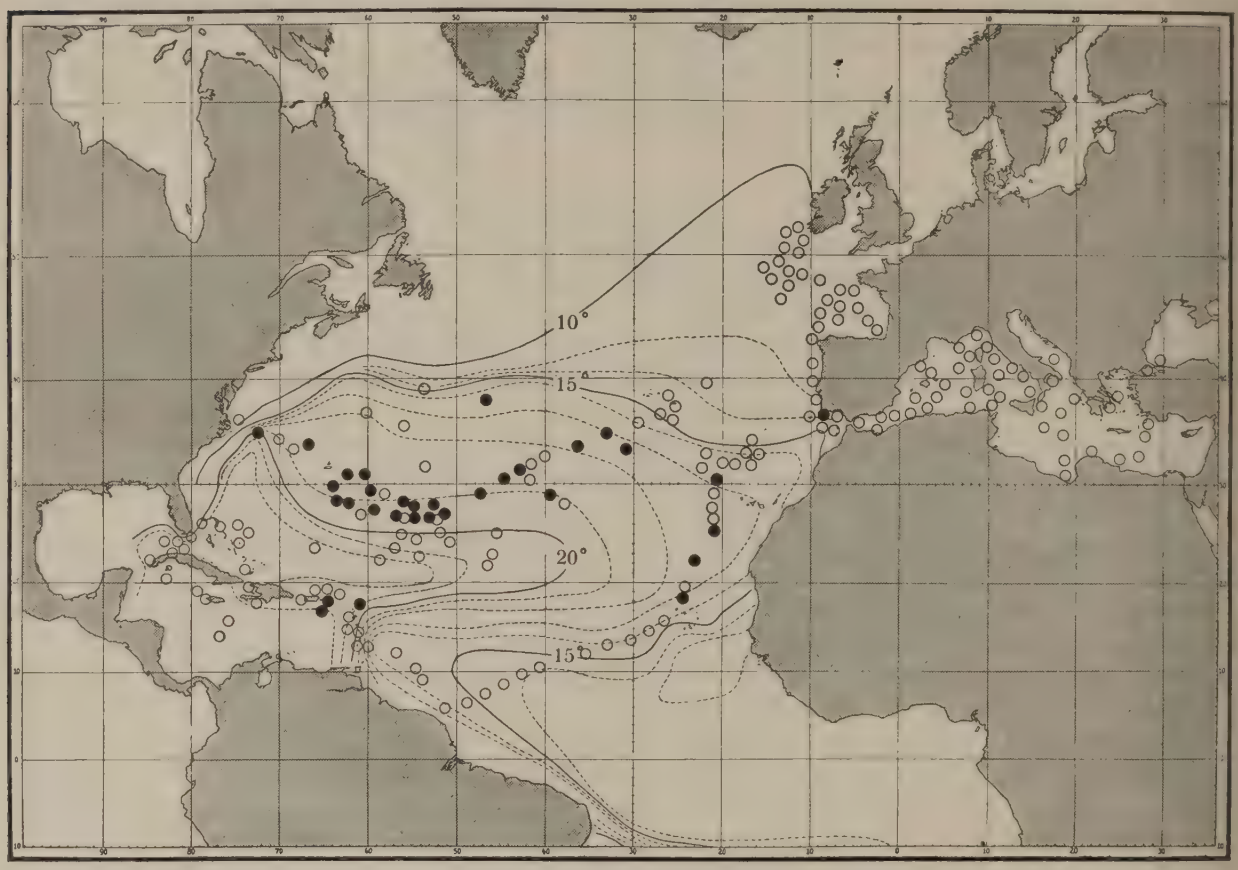

Fig. 29. Distribution of the postlarvæ of *Paralepis brevis* Zugmayer. ● Positive stations. ○ Negative stations, *viz.* the negative stations of the "Dana" at which 400 to 800 meter lengths of wire were used, also the negative stations of the "Thor" at which 300 to 600 meter lengths of wire were used. The isotherms at a depth of 150 meters are indicated (after Schott 1902).

M. W.	25	50	100	200	300	400	500	600	700	800	1000	>1000
Number of hours	2	47	74 1/2	52 1/4	75 1/4	29 3/4	30 1/4	84 3/4	20 1/2	38 1/2	91	166
Length 5—6 mm.												
Number of specimens	..	..	..	..	9	9	11	5	..	..	..	..
No. of spec. div. by no. of hours	..	..	..	..	0.1	0.3	0.4	0.1	..	..	..	..
Length 6—8 mm.												
Number of specimens	..	..	..	..	10	16	12	29	..	..	..	..
No. of spec. div. by no. of hours	..	..	..	..	0.1	0.5	0.4	0.3	..	..	..	..
Length 8—10 mm.												
Number of specimens	..	..	..	8	1	26	31	124	9	5	..	2
No. of spec. div. by no. of hours	..	..	..	0.2	0.0	0.9	1.0	1.5	0.4	0.1	..	0.0

M.W.	25	50	100	200	300	400	500	600	700	800	1000	>1000
Length 10—15 mm.												
Number of specimens	..	..	..	1	6	7	2	29	9	..	1	1
No. of spec. div. by no. of hours	..	..	..	0.0	0.1	0.2	0.1	0.3	0.4	..	0.0	0.0

The catch of the 14 specimens, > 15 mm. in length, is distributed over the following lengths of wire:— 8 specimens were taken with 3000, 4 with 4000 and 2 with 5000 m.w.

As will be seen, only a very small portion of the aggregate number was taken with a wire less than 300 m., of the smallest specimens and those next in size, none whatever was taken. These two sizes are not very different from each other, most of the specimens of both having been taken with 400 and 500 m.w., but, even here, there can already be traced a shifting downwards during growth, as about the same number of specimens 6—8 mm. in length were taken with the 600 m.w. as with the lengths mentioned, while the catch of specimens less than 6 mm. is smaller with 600 m.w. than with 300 m.w. Of specimens 8—10 mm. in length, most were taken with 600 m.w., on an average about $1^1/_2$ times as many as with 500 m.w., while the number caught with this length of wire and with 400 m.w. is still about the same; besides, the use of greater lengths of wire, 700 and 800 m., has yielded catches, though comparatively small, as regards this size-group. Finally, the proportional figures for the fourth size-group show a continued shifting downwards of the largest number, as the number achieved with 700 m.w. is about double that resulting from the use of 400 m.w.

The main portion of the above material was collected between the 15th of March and the 11th of June, only 24 specimens were taken between the 13th of September and the 8th of December.

Relation between vertical and horizontal distribution. By using the above results to estimate the approximate depths at which specimens at the different stages of development are for the most part found, one encounters, as usual, the difficulty that precise information is lacking with respect to the proportion between the length of wire used and the depth to which the fishing apparatus has reached. As stated, this proportion for the smaller lengths of wire (up to 500 m.) is estimated, on an average, to be 3 to 1.

The smallest postlarvæ were, for the most part, taken with 400 and 500 m.w. which lengths should thus correspond to a depth of about 150 m. However merely approximately correct this result may be, there can be no doubt that a certain dependence exists between the temperature at which the tiny postlarvæ occur and the horizontal limit for the occurrence of the postlarvæ in general. On the chart, Fig. 29, which shows the distribution of the postlarvæ, isotherms are noted as (according to SCHOTT, 1902) they prevail at a depth of 150 m. Furthermore, plain circles mark the stations taken by the "Dana" where 400—800 m. lengths of wire, the lengths with which the postlarvæ of the species are principally taken, have been used, and also those taken by the "Thor" where lengths of 300—600 m. have been used and which, however, are negative in respect of catches of the species. The filled-in circles indicate positive stations.

As will be seen, there is generally an agreement between the occurrence of the postlarvæ and the course of the isotherms. The distribution of the postlarvæ comes within areas where at the depth in question there are temperatures between 16° and 22°. The position of both the southern and the northern limit for the entire area of distribution is thus contingent upon the temperature south and north (incl. northwest) of the area being too low, while the distribution towards the south-west is limited by a rise in the temperature. The isolated occurrence around the Lesser Antilles seems, towards the north, to be separated from the nearest lying other positive localities by an area where the temperature is too high or in any case is above the optimum for the occurrence of the youngest postlarval specimens; its sequestration from the easterly occurrence is on the contrary perfectly artificial, as no researches whatever have been

made in the area between the northerly Lesser Antilles and the Cape Verde Islands and between about 16° and 21° N. lat. Catches of postlarvæ of the species might have been expected at the nearest southerly stations, however it must be remarked that at the station off the Cape Verde Islands (St. 1159) only two specimens have been taken and that the temperature in the area in question, where the isotherms are so densely crowded, must be assumed to vary comparatively greatly at the same place.

For the purpose of judging the value of the limitation found, the chart, as mentioned, is marked to show negative stations, as regards catches, at which the lengths of wire, with which the postlarvæ of the species were taken, have been used. It will be seen that, as far as the westerly and north-westerly portion is concerned, the northern limitation is not well defined, while in its easterly part it is marked by so many negative stations that it must be considered a reality, and the isolated catch of three specimens at the entrance to the Bay of Cadiz (at St. 1107), in one of the best investigated areas, an exception. That the southerly limitation found is likewise approximately correct, appears from the fact that the species has not been found at any of the many stations where deep-sea researches have been carried out, on the stretches between the Cape Verde Islands and the coast of Guiana and between the latter and the Antilles. As regards the westerly limitation, there is quite a number of negative stations in the said area between the isolated positive stations around the Antilles and those lying to the north and north-east of them, so that the southern limit for the common occurrence of postlarvæ really seems to run parallel with the isotherms in that area. That the postlarvæ of the species are at any rate not found in the hottest areas, is demonstrated by the absence of an occurrence at the many stations around the Bahama Islands, in the Straits of Florida and among the Greater Antilles.

The temperature at a depth of 150 meters, observed by the "Dana" at the stations (with the exception of St. 1107) where the postlarvæ of the species were taken, lies between 16°.64 (St. 1367) and 22°.49 (St. 1189). These observations agree fairly well with the relation between the course of SCHOTT's isotherms and the limitation of the distribution of the postlarvæ.

Propagation. Small postlarval specimens, < 15 mm. in length, have been taken in the months of March—June and August—October. Of the remaining months no researches have been made in January and February within the distribution area of the postlarvæ.

5. PARALEPIS SPHYRÆNOIDES Risso.

Material. The material which forms the basis of this investigation consists of 853 specimens, which, with the exception of a few adolescents, are postlarvæ and of which 264 are derived from the Mediterranean cruises of the "Thor", 160 were collected in the Alboran Sea by the "Dana", and 14 by Capt. G. Hansen, in the Straits of Messina, and by the S/S "Pangan", while the remainder, 415 specimens, were taken in the Atlantic.

Horizontal distribution. The species is first known from Nice (RISSO 1826, BELLOTTI 1877). VERANY mentions its occurrence in the Gulf of Genoa (1846), ERHARD in the Ægean Sea (1858). Outside the Mediterranean, the Monaco yacht "Princesse-Alice" took individual specimens at two stations in 1895 at 38°.25′ N. lat., 20°.60′ W. long. and at 32°.32′ N. lat., 17°.04′ W. long. (ROULE 1919).

The distribution of the postlarvæ in the Mediterranean differs in a high degree from that of the preceding species (see Fig. 30 and 31). While the postlarval specimens of these latter are spread over most parts of the Mediterranean without any great difference between the western and the eastern basin, the postlarvæ of this species in the eastern basin were taken only in the northerly parts, namely the northern and north-western portion of the Ionian Sea bounded on the south by about 37° N. lat., on the east by about 16° E. long.,

and the northerly portion of the Ægean Sea bounded on the south by about 38° N. lat. In the western area the postlarvæ were taken in its entire stretch from Gibraltar to the Straits of Messina and in the Ligurian Sea; only at the stations in the waters round the Balearic Isles they are entirely lacking also at the stations north of that group which were taken above great depths. But the number of individuals differs very greatly in the different portions, being largest in the Alboran Sea and along the coast of Africa, decreasing northwards, as it is shown by the comparatively large number of negative stations and the far smaller catches at the positive stations in the northerly portion; of the 264 specimens collected by the "Thor" only 20 were derived from stations situated north of 40° N. lat.

As regards the relation of the distribution to the depth the presence of postlarvæ in the northerly portion of the Ægean Sea might imply that this species demands less in that respect than the species discussed in the foregoing.

In the Atlantic the postlarvæ were found between about 30° and about 50° N. lat. and between Gibraltar and about 45° W. long.

Vertical distribution. The following survey embraces the material collected by the "Thor" in the Mediterranean. The winter and summer material are treated separately. The hour figures and proportion figures indicate the same as in the case of the aforementioned species.

	M.W.	10	25	65	100	150	200	300	400	500	600	1000	>1000
Winter	Number of hours	1/2	12 1/2	14	2	3 1/2	3 1/2	11	1/2	1/2	3 1/2	7	5
Summer	do.	1/4	6 3/4	3	0	0	0	9 1/2	0	0	1	3 1/2	7
	Length < 10 mm.												
Winter	Number of specimens	.	1	7	..	..	..	..	..	..	..	..	.
Summer	do.	.	3	..	..	..	..	..	..	..	..	1	..
	Length 10—15 mm.												
Winter	Number of specimens	1	3	25	3	..	..	2	..	..	1	..	..
	No. of spec. div. by no. of hours	2.0	0.2	1.8	1.5	..	..	0.2	..	..	0.3	..	..
Summer	Number of specimens	..	10	2	..	..	..	8	..	..	..	1	..
	No. of spec. div. by no. of hours	..	1.5	0.7	..	..	..	0.8	..	..	..	0.3	.
	Length 15—25 mm.												
Winter	Number of specimens	2	10	20	5	..	10	5	..	..	4	..	1
	No. of spec. div. by no. of hours	4.0	0.8	1.4	2.5	..	2.9	0.5	..	..	1.1	..	0.2
Summer	Number of specimens	1	29	11	..	..	..	12	..	..	1	1	2
	No. of spec. div. by no. of hours	4.0	4.3	3.7	..	..	..	1.3	..	..	1.0	0.3	0.3
	Length > 25 mm.												
Winter	Number of specimens	..	9	9	3	1	1	6	..	1	1	1	..
	No. of spec. div. by no. of hours	..	0.7	0.6	1.5	0.3	0.3	0.5	..	2.0	0.3	0.1	
Summer	Number of specimens	..	25	11	..	..	..	11	..	..	1	..	2
	No. of spec. div. by no. of hours	..	3.7	3.7	..	..	..	1.2	..	..	1.0	..	0.3
	The entire material												
Winter	Number of specimens	3	23	61	11	1	11	13	..	1	6	1	1
	No. of spec. div. by no. of hours	6.0	1.8	4.4	5.5	0.3	3.1	1.2	..	2.0	1.7	0.1	0.2
Summer	Number of specimens	1	68	23	..	..	..	31	..	..	2	3	4
	No. of spec. div. by no. of hours	4.0	10.1	7.7	..	..	..	3.3	..	..	2.0	0.9	0.6

In judging the above results one must as usual take into consideration that the different figures are far from being representative in the same degree, on account of the different lengths of wire not having been used to the same extent. Of the winter material, the most suitable for comparison with each other are the catches made with 25, 65 and 300 m.w., of the summer material, those made with 25 and 300 m.w.

Unfortunately, there are only so few of the smallest specimens, less than 10 mm. in length, available; but it appears, sufficiently clearly however, that these can be taken in the upper layers equally as well in summer as in winter. This circumstance is confirmed also by the vertical distribution of the specimens next in size of which the use of 25 m.w. gives the largest catch in summer, while that in winter seems to be attained with 65 m.w. This difference in respect of the apportionment between 25 and 65 m.w. is faintly to be seen in the next size-group (15—25 mm.), but is obliterated in the larger specimens, of which the same number was caught with these two lengths of wire both summer and winter. As regards 300 m.w. the state of things is not so clear. Of the fairly small specimens (10—15 mm.) a comparatively larger number seems to be caught with this length of wire in the summer than in the winter, while the reverse seems to be the case with regard to the larger specimens. The main result, however, is, that the smallest specimens and those next in size were, in summer, taken in at least equally large numbers with 25 m.w. as with the greater lengths of wire. In this respect the species differs in the highest degree from *P. rissoi rissoi* and *P. coregon. coregon.*, the small specimens of which were taken, with the exception of a single one, with larger lengths of wire in the summer.

Consequently, we may conclude that the temperature in the layers near the surface, in contrast to what must be assumed as being the case in regard to the two forms mentioned, does not even in summer, within the greater portion of the ascertained horizontal distribution area of the postlarvæ in the Mediterranean, exceed the maximum for the occurrence of the tiny postlarval specimens.

For regularity's sake, a statement is given below of the number of specimens of the different sizes taken by the "Dana" at eight stations in the Alboran Sea, at the end of September and the beginning of October 1921. The material must be but slightly representative, as the different proportions between depth and length of wire to be reckoned with in a comparison between the material of the "Thor" and that of the "Dana" cannot alone explain the disagreement between these two.

M.W.	25	50	100	150	200	250	300	400	500
Number of hours	2½	4½	15	12½	17	7½	11½	2	1
Length < 10 mm.	..	..	..	..	2	..	1	..	..
» 10—15 »	..	..	..	..	26	5	5	..	..
» 15—25 »	..	..	7	..	60	6	20	1	..
» > 25 »	..	..	3	..	12	4	6	2	

Finally, a synopsis of the state of things in the Atlantic is given. As the materials from the different expeditions cannot be considered perfectly comparable with one another, only those specimens collected by the "Dana" during her cruise in 1921—22 are included in the synopsis below. The hour figures give the aggregate of the hours during which the respective lengths of wire were used at the stations where the postlarvæ of the species were taken. These positive stations were taken between the 9th of June and the 15th of October.

M.W.	25	50	100	150	200	250	300	350	400	500	> 500
Number of hours	6	50	58	9	61	4	57	3	19	7	72
Length < 10 mm.											
Number of specimens	..	..	1	..	..	..	..	1	1	2	

M.W.	25	50	100	150	200	250	300	350	400	500	>500
Length 10—15 mm.											
Number of specimens	..	..	6	..	12	..	2	1	..	2	
No. of specimens div. by no. of hours	..	..	0.1	..	0.2	..	0.0	0.3	..	0.3	
Length 15—25 mm.											
Number of specimens	1	7	11	5	4	..	3	..	..	1	..
No. of specimens div. by no. of hours	0.2	0.1	0.2	0.6	0.1	..	0.1	..	..	0.1	..
Length 25—40 mm.											
Number of specimens	8	23	24	1	28	..	23	..	..	..	4
No. of specimens div. by no. of hours	1.3	0.5	0.4	0.1	0.5	..	0.4	..	..	..	0.1
The entire material											
Number of specimens	9	30	42	6	44	4	28	2	1	5	4
No. of specimens div. by no. of hours	1.5	0.6	0.7	0.7	0.7	1.0	0.5	0.7	0.1	0.7	0.1

The material illustrates but little as to the vertical occurrence of the smallest specimens, but yet so much that they can be taken with 100 m.w. That this circumstance is no exception, is evident from the fact that the M/S "Dana" took 14 specimens measuring less than 10 mm. at St. 900 with 100 m. w. in a single haul. These facts in conjunction with the vertical distribution of specimens of the next size (10—15 mm.) would suggest that the occurrence of the smallest specimens must, for the most part, be assigned to depths between those corresponding to 100 and 200 m.w., and that the specimens taken with 350—500 m.w. do not originate from depths corresponding to these lengths of wire but have been caught while the apparatus was being hauled in. Of specimens, 15—25 mm. in length, most were taken with 100 m.w., and catches were made with smaller lengths, while specimens, 25—40 mm. in length, can be taken in the same number with lengths of wire from 50 m. to 300 m. and apparently in at least equally large number with 25 m.w.

Relation between vertical and horizontal distribution. In respect to the relation in the Mediterranean between the vertical distribution of the smallest postlarval specimens and the horizontal distribution of the postlarvæ in general, it must be remembered that even in summer the smallest postlarvæ can be taken with so small a length of wire as 25 m. and apparently in equally large numbers as with greater lengths. As specimens of postlarvæ are to be found in the greater part of the recognized area of their horizontal distribution both summer and winter, it must be concluded that an occurrence of the youngest specimens is possible within more extended limits of temperature than is the case as regards the two previously discussed Mediterranean forms (*P. rissoi rissoi* and *P. coregon. coregon.*). That the species, on the other hand however, is far from being indifferent to the temperature, is demonstrated *inter alia* by the absence of postlarvæ at the stations in the greater part of the eastern basin, a horizontal limitation, the presence of which has been ascertained only in summer, that must even be considered in relation to the vertical occurrence of the postlarvæ at that time of the year, especially that of the smallest specimens.

The largest numbers of the smallest specimens and those next in size were, in summer, taken with 25 m.w. As during the cruises of the "Thor" the proportion between the depths and the respective lengths of wire used may be, approximately, reckoned as 1 to 2, the temperatures which, for the most part, have to be taken into consideration, must lie nearest to those observed to be prevailing at a depth of 10 meters, yet presumably slightly divergent, therefore in the following these temperatures as well as those

at a depth of 25 meters are given. There are no directly comparable observations at hand, from the Danish expeditions, to illustrate the relation between the two areas, the Alboran Sea where the postlarvæ most commonly occur, and the large part of the eastern basin where no specimen was found, as the observations of the "Thor" were, as we know, made at somewhat different times of the year. These are, however, so close to each other that the temperatures found are particularly suitable for use in forming an estimate of this relation.

Below are given the extreme values of a few observations (St. 218—224) taken in the Alboran Sea from the 2nd to the 7th of September, which consequently may be assumed to be very near the highest temperatures occurring in that area, and also the extreme values of temperature observed in a part of the eastern basin where the postlarvæ of the species were not found; these latter observations were made from the 24th of July to the 1st of August so that the values may be assumed to be somewhat lower than the maximum occurring in that sea. The difference between the two areas is consequently, it may be presumed, somewhat greater than these observations show:—

Depth	10 m.	25 m.
Alboran Sea	22°.85—23°.45	17°.10—21°.75
Eastern basin	24°.09—26°.05	21°.70—24°.55

Considered in the light of the figures given, the observations at St. 143 (the only station in the Ionian Sea where postlarvæ of the species were taken in summer) and its neighbour station 144 supply a good explanation of why specimens were taken at one station and not at the other:—

Depth	10 m.	25 m.
St. 143	23°.08	17°.28
» 144	25°.30	22°.50

During the winter cruise the largest numbers of the smallest specimens and those next in size were taken with 65 m.w. Observations of the temperature taken just at the very coldest time of the year, the 6th to the 21st of February (St. 45—60) are at hand from the Alboran Sea and the coast of Algeria. The temperature at the depths under discussion, which, by the way, differs but little from that at the surface, varies between the following values:—

Depth	25 m.	50 m.
	13°.40—14°.51	13°.58—14°.50

No observations made during the winter are recorded from the part of the eastern basin under discussion; according to SCHOTT (1915) the surface temperature in that area in February is about 15°—17°. As the occurrence of postlarvæ in the Alboran Sea also at this time of the year appears to be fairly common, there would consequently be good conditions in winter, as far as the temperature is concerned, for the occurrence of postlarvæ in the eastern basin. Whether there are any, cannot be determined on account of deficient investigation.

As mentioned, the results of the catches in the Ligurian Sea and the adjacent regions show that the number of postlarvæ in this part of the western basin must be far smaller than in the southerly and south-westerly part. No specimens were taken in the Ligurian Sea during the winter cruise and only a single one during the summer cruise, at St. 125. The most northerly positive stations, apart from the one just named, are, in the Tyrrhenian Sea St. 31 in the latitude of the southerly part of Corsica, and in the Balearic Sea St. 118, about in the latitude of the north point of Sardinia.

Within the thus limited area the Danish expeditions have not made any researches at the very coldest time of the year, but yet at a time not very far from it, *viz.* the end of January. Except as regards a single station (St. 32), the temperatures observed are as follows:—

Depth	25 m.	50 m.
	12°.48—13°.08	12°.49—13°.15

According to Schott (1915) the surface temperature in February, within the area in question, is 12°—13°.

Fig. 30. Distribution of the postlarvæ of *Paralepis sphyrænoides* Risso. The isotherms at a depth of 50 meters are indicated (after Schott 1902).

The winter temperature is thus distinctly lower than in the Alboran Sea and may explain the rare occurrence, or non-occurrence, in winter, as presumably it is lower than what is favourable for the occurrence of tiny postlarvæ. It is perhaps less easy to understand that the scanty catches during the summer cruise imply a similar rare occurrence at that time of the year. One must suppose that the common occurrence of the postlarval specimens of the species, which propagates both summer and winter, is confined to areas where external conditions in that respect are favourable, both summer and winter.

The ascertained conditions in the Ligurian Sea and the adjacent areas might thus imply that, during winter, postlarvæ are not present in the aforementioned fairly large part of the eastern basin where the absence of an occurrence in summer has been proved.

Besides the area just referred to there is, in the western basin, a smaller portion where the

presence of postlarvæ of this species has not been proved, *viz.* the vicinity of the Balearic Isles. Like the aforementioned part of the eastern basin, this region has been investigated only during the summer. All stations situated in this region, St. 205—17, have yielded negative results; a number of these were taken in shallow water, within the 200 meter isobath, which may perhaps explain the non-occurrence at these stations; but as regards the five stations beyond the 1000 meter isobath, the cause must be ascribed to the same conditions as prevail in the eastern basin, the presence of a temperature, at the hot time of the year, that is higher than what is favourable for the occurrence of the youngest postlarvæ, or higher than the temperature maximum for such occurrence. Hydrographical observations from three of these stations are available; the temperatures are as follows:—

Depth	10 m.	25 m.
St. 206	24°.95	24°.6
» 209	24°.3	23°.85
» 217	24°.4	17°.3

Of these figures, five give distinctly higher temperatures than those observed a few days later in the Alboran Sea (St. 218—24) which, at the depths in question, were:—

Depth	10 m.	25 m.
	22°.85—23°.45	17°.10—21°.75

Finally, it may be mentioned that St. 14 in the Adriatic, at which the species has not been found, is situated at a place where the surface temperature (according to SCHOTT, 1915) is only 12°—13° in February, that is to say, the same as in the Ligurian Sea.

An explanation of how matters stand in the Atlantic is rendered difficult, as already stated, by the absence of a satisfactory number of the smallest postlarval specimens in the material of the "Dana". However, as mentioned, the probability is that the smallest specimens occur, for the most part, at depths corresponding to 100—200 m.w. If, as usual, one reckons the depth at about $^1/_3$ of the length of the wire, the occurrence of the smallest specimens should be at somewhere about a depth of 50 meters. On the chart Fig. 30, which shows the distribution of the postlarvæ in general, the isotherms (according to SCHOTT 1902) are noted at this depth. As will be seen, the course of these isotherms does not explain why the ascertained westerly limitation of the area of distribution lies so far east as at about 45° W. long. There are, however, several circumstances that suggest that the lack of catches in the area lying to the west of the said degree of longitude, bounded on the north and south by the isotherms that seem to limit the distribution, may possibly not be an indication of the absence of an occurrence. Within this area there are only a few of the research-vessel stations which empirically give better results than the stations of other vessels, and those that are present are situated close to the lines of the isotherms which define the boundary.

The minimum and the maximum temperatures for the occurrence of the smallest postlarvæ should thus correspond to limitations, as to temperature, defined by yearly average values of about 12° and 20° respectively. Observations of the extreme temperatures at the depths in question are not available; as moreover a basis for the estimation of the level for the occurrence of the smallest postlarvæ is, as stated, very deficient as far as the Atlantic is concerned, one is unfortunately debarred from a comparison between the stocks of the Atlantic and the Mediterranean in respect of the temperatures they demand.

This circumstance is all the more regrettable as a pronounced difference exists between the average values of the figures of vertebræ in the specimens from the two areas, as the results given below will show:—

	Atlantic (St. 1371, 1374, 1377—78 and 1380)	Mediterranean
93	oooo	
92	oooooooooooooooooooooooooooo	oo
91	oooooooooooooooooooooooooo	oooooooooooooooooo
90	ooooo	ooooooooooooooooooooooooooooooo
89	o	oooooooo
88		o

The average values are:— $a_{69} = 91.46$ and $a_{95} = 90.22$, there is thus a difference of 1.24 between them.

The figures of vertebræ in specimens taken in the Bay of Cadiz are also of interest:—

92	
91	o o o o o o o o o o o
90	o o o o o o
89	o o

The asymmetrical curve suggests that there is here a blending of specimens from the two areas.

Propagation. In the Mediterranean, small postlarval specimens, < 15 mm. in length, have been taken from the middle of December to the end of February and from the end of June to some time in September (by the "Thor"), in March and the beginning of April (by Capt. Hansen) and at the end of September and the beginning of October (by the "Dana"), so that specimens have not been taken during only two months. Consequently, the state of things is similar to that found as regards *P. rissoi rissoi* and *P. coregon. coregon.* and shows that spawning takes place for the greater part of the year, most likely all the year round.

In the Atlantic, postlarvæ of the same size were met with in most months, only not in January, May and June. To what extent the occurrence is the same within the whole area of distribution cannot be determined; in the northerly part, north of about 41° N. lat., the occurrence has, thus, been ascertained only in summer.

6. PARALEPIS PSEUDOSPHYRÆNOIDES Ege.

a. PARALEPIS PSEUDOSPHYRÆNOIDES THORI Ege.

Material. The material consists of 1521 specimens which, with the exception of a few adolescent individuals, are postlarvæ. 364 specimens were collected in the Mediterranean, *viz.* 288 by the "Thor", 18 by the S/S "Pangan" and 58 by the "Dana" in the south-westerly part of the Balearic Sea, while the rest, 1157 specimens, were taken in the Atlantic by the "Dana" and other vessels.

Horizontal distribution. The distribution in the Atlantic stretches across the ocean in a rather narrow belt which reaches almost from one coast to the other (see Fig. 32). The westerly part of the area of distribution is bounded on the south by about 28°, on the north by about 40° N. lat., while the easterly part is bounded on the south by about 20°, on the north by about 36° N. lat. The northern limit of the middlemost part reaches right up to about 43° N. lat., the southern limit lies at about 30° N. lat., but, in contrast to the southern limit of the easterly and westerly portions of the area of distribution, it is not very

definitely determined on account of a deficient investigation of the area lying immediately to the south, and is most likely situated somewhat further southerly than ascertained.

As will be seen from the chart Fig. 31, the distribution of the postlarvæ in the Mediterranean forms, in several respects, an interesting contrast to the state of things found in *P. sphyrænoides*. The postlarvæ of that species are not found in the large southerly part of the eastern basin, while *P. pseudosphyrænoides* is found spread over the whole of this area. The distribution in the western basin, likewise, presents great differences between the two species. While *P. sphyrænoides* is spread right up to Gibraltar and most

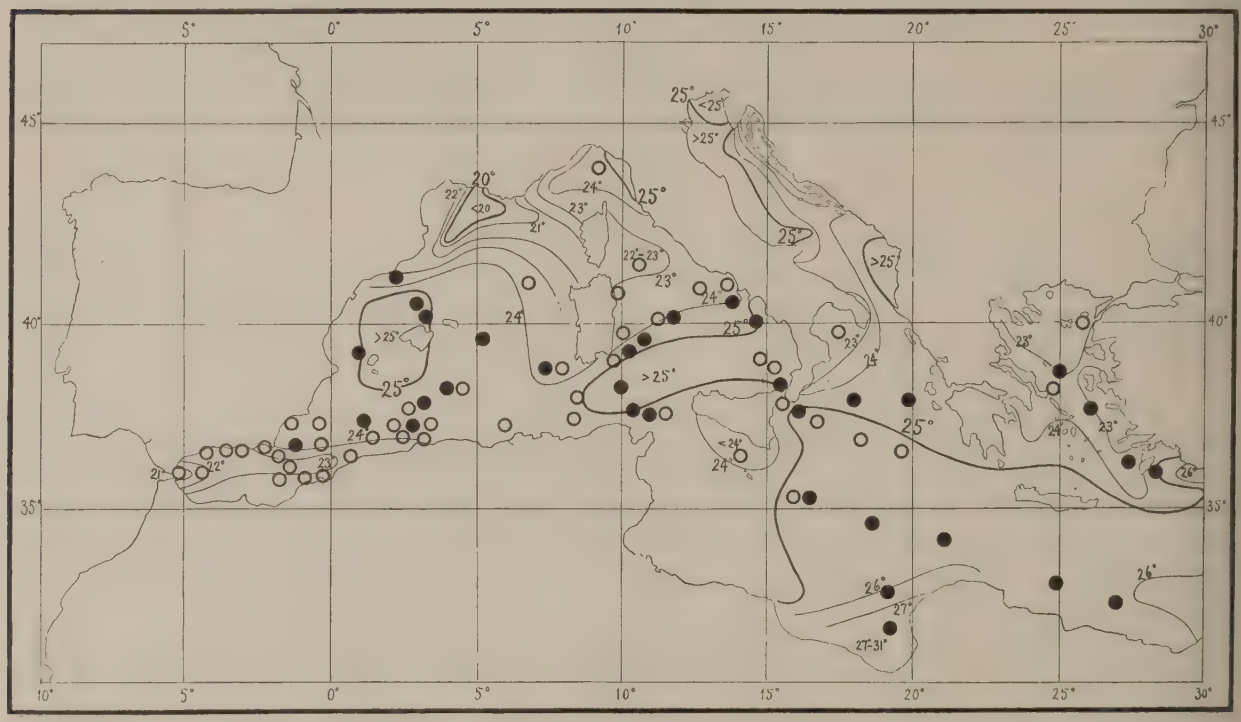

Fig. 31. Distribution of the postlarvæ of: ○ *Paralepis sphyrænoides* Risso and ● *Paralepis pseudosphyrænoides thori* Ege. Surface isotherms in August are indicated (after Schott 1915).

commonly occurs in the Alboran Sea and along the Algerian coast, *P. pseudosphyrænoides* was not taken at any of the stations of the "Thor" or of the "Dana" in the Alboran Sea and only at a single one (St. 530) in its easterly part, by the S/S "Pangan". The distribution of *P. sphyrænoides* extends right into the Ligurian Sea, though the species seldom occurs there, while the northern limit for the distribution of *P. pseudosphyrænoides* lies near about 41° N. lat. Finally, *P. sphyrænoides* is not found in the waters around the Balearic Isles, while *P. pseudosphyrænoides* seems to occur commonly in that area.

Vertical distribution. The following synopsis embraces the material collected in the Mediterranean by the "Thor". In contrast to the state of things in the aforementioned species, no material of this species, collected during the winter cruise, is at hand.

M.W.	10	25	65	100	150	200	300	400	600	1000	>1000
Number of hours	1	12	3/4	1/3	1/3	1/4	9 1/6	..	1 1/3	10	9 1/3
Length < 10 mm.											
Number of specimens	..	11	..	..	..	..	1	..	..	..	..
No. of specimens div. by no. of hours	..	0.9	..	..	..	..	0.1	..	..	..	..

M.W.	10	25	65	100	150	200	300	400	600	1000	>1000
Length 10—15 mm.											
Number of specimens	5	108	2	..	..	..	4	..	1	1	..
No. of specimens div. by no. of hours	5.0	9.0	2.7	..	..	..	0.4	..	0.7	0.1	..
Length 15—25 mm.											
Number of specimens	4	120	..	..	..	1	2	..	..	5	1
No. of specimens div. by no. of hours	4.0	10.0	..	..	..	..	0.2	..	..	0.5	..
Length > 25 mm.											
Number of specimens	..	17	..	..	..	..	3	..	..	..	2
No. of specimens div. by no. of hours	..	1.4	..	..	..	..	0.3	..	..	..	0.2
The entire material											
Number of specimens	9	256	2	..	..	1	10	..	1	6	3
No. of specimens div. by no. of hours	9.0	21.3	2.7	..	..	..	1.1	..	..	0.6	0.3

As will be seen, the smallest specimens have by preference been taken with 25 m.w. To judge from the insignificant catches of specimens of all sizes made with 300 m.w. and greater lengths of wire, it is very likely that the individual specimen, taken with 300 m.w., originates from a higher level than what is indicated by this length of wire. The circumscribed use of the intermediate lengths, 65—200 m.w. renders it difficult, as it always does, to judge of the relation between these lengths and those used in a higher degree, in the present case especially to determine what significance may be assigned to the negative result obtained by the use of 65—200 m.w. in relation to the catch given by 25 m.w. The distribution of the larger material of the smallest but one specimens (10—15 mm.), of which most have been taken with 25 m. w. and a greater number with 10 m.w. than with 65 m.w., shows, however, that the ascertained result, as regards the smallest specimens, can hardly be considered very misleading, at any rate, that a catch of a similar size to that produced by the use of 25 m.w. could scarcely be obtained by the use of a wire of a greater length than 65 meters. The distribution of the specimens of the other sizes among the different lengths of wire is not very different to that of the smallest but one specimens. It may be mentioned that the number of specimens above 25 mm. in length, taken with 300 m.w., is comparatively larger than that of the other sizes taken with the same length of wire.

The 58 specimens taken by the "Dana" in the south-westerly part of the Balearic Sea during the end of September and the 1st of October are distributed in the following manner among the different lengths of wire.

M.W.	25	50	100	150	200	250	300
Number of hours	2	2	$9^1/_2$	$8^1/_2$	$11^1/_2$	$5^1/_2$	6
Length < 10 mm.	..	..	2	..	..	2	
» 10—15 »	2	3	2	..	..	4	
» 15—25 »	8	8	4	3	3	8	
» 25—40 »	..	2	1	1	2	1	..
» >40 »	..	..	..	..	1	..	1
The entire material							
Number of specimens	10	13	9	4	6	15	1
No. of spec. div. by no. of hours	5.0	6.5	0.9	0.5	0.5	2.7	0.2

Much the same number of specimens has therefore been taken with 25 m.w. as with 50 m.w., whereas the main part of the specimens of the "Thor" has been taken with 25 m.w. Thus, these two

materials present quite a good proof that one gets close to the actual proportion between the depths a given length of wire represents by the working methods of the "Dana" and of the "Thor", if one reckons it to be as 2 to 3, at any rate as regards the small lengths under discussion.

The material of the "Dana" from the Atlantic consists of 278 specimens, of which the majority, 219, were collected between the 9th of May and the 9th of June, the rest between the 14th of September and the 23rd of October. In the following a synopsis is given of the distribution among the several lengths of wire:—

M.W.	25	50	100	150	200	300	400	500	>500
Number of hours	4	35¼	57¼	26½	61¾	60¼	23¾	14	
Length < 10 mm.									
Number of specimens	..	7	21	..	..	..	..	..	
No. of specimens div. by no. of hours	..	0.2	0.4	..	..	..	..	..	..
Length 10—15 mm.									
Number of specimens	3	75	27	8	15	3	..	1	1
No. of specimens div. by no. of hours	0.8	2.1	0.5	0.3	0.2	0.0	..	..	..
Length 15—25 mm.									
Number of specimens	..	71	12	2	8	7	3	..	1
No. of specimens div. by no. of hours	..	2.0	0.2	0.1	0.1	0.1	0.1	..	..
Length 25—40 mm.									
Number of specimens	1	1	..	..	2	8	..	1	..

The smallest specimens have been taken with 50 and 100 m.w., most of them with the latter length of wire, while the specimens of the subsequent sizes were taken chiefly with 50 m.w. If the depth is reckoned as being ⅓ of the length of the wire, then the depth at which the smallest specimens, for the most part, occur must be assumed to be somewhere about 25—30 m.

During the cruise of the M/S "Dana" in 1920, a considerably larger material of the postlarvæ of the form under discussion was collected between the 8th of June and the 24th of August. Even though the materials from the two vessels are not quite suitable for comparison in respect of the distribution among the different lengths of wire, it will, however, be of interest to have a view of the material from 1920 as well, particularly as it includes a large number of the smallest specimens. The 694 specimens are distributed as follows:—

M.W.	25	50	100	150	200	300	400	500	>500
Number of hours	8	50	55½	54	20	4	0	4	3
Length < 10 mm.									
Number of specimens	..	7	92	59	..	..	..	..	
No. of specimens div. by no. of hours	..	0.1	1.7	1.1	..	..	..	..	..
Length 10—15 mm.									
Number of specimens	1	170	88	24	..	..	..	..	
No. of specimens div. by no. of hours	0.1	3.4	1.6	0.4	..	..	..	..	..
Length 15—25 mm.									
Number of specimens	..	137	33	20	..	..	..	..	..
No. of specimens div. by no. of hours	..	2.7	0.6	0.4	..	..	..	..	..

M.W.	25	50	100	150	200	300	400	500	>500
Length 25—40 mm.									
Number of specimens		13	26	19					
No. of specimens div. by no. of hours		0.3	0.5	0.4					
Length > 40 mm.									
Number of specimens		1	2	2					

It will be seen that the largest number of the smallest specimens, from this vessel as well, has been taken with 100 m.w.; but there is, however, this difference between the above material and that of the R/S "Dana" that the largest number but one is derived from catches with 150 m.w., while that of the R/S "Dana" was taken with 50 m.w. and no specimen from this vessel was taken with 150 m.w. This difference is found again in the larger specimens though in a less pronounced degree. Whether this little difference is due to the circumstance that the material was taken at another time of the year than that of the R/S "Dana", and might thus possibly be an expression of a corresponding displacement of the level of the postlarvæ, occasioned by a rise in temperature, or merely indicates that the proportion between the length of wire and depth is not quite the same as regarding the R/S "Dana", cannot be decided.

Relation between vertical and horizontal distribution. In judging the relation, in the Mediterranean, between the vertical occurrence of the smallest postlarval specimens and the horizontal distribution of the postlarvæ in general, this particular circumstance must above all be taken into consideration that postlarval specimens were not taken during the winter cruise of the "Thor", that is to say that they can hardly be said to occur in the western basin and the northerly part of the Ionian Sea from the middle of December to the beginning of February, during which period the stations, lying within the ascertained area of distribution of the postlarvæ, were taken on that cruise. How much more restricted this ascertained seasonal limitation is than the actual, cannot be determined for lack of material; though it deserves to be mentioned, that while making his collection in the Straits of Messina during March and the beginning of April 1911 Capt. Hansen did not find any specimen of this form, whereas he got 13 postlarvæ of *P. sphyrænoides*. As regards this locality, therefore, the negative period must at any rate be assumed to extend into April. Very likely the same is the case in the rest of the area. How far into the autumn postlarvæ may occur, is not known as regards the western basin; in the eastern basin an individual specimen was taken on the 7th of November (St. 384).

The vertical occurrence of the smallest postlarvæ agrees very well with the seasonally limited occurrence. As stated, they were, with a single exception, taken with 25 m.w., and the vertical distribution of the larger material of the smallest but one specimens shows that this is no accidental occurrence, and that catches of specimens of this size would only rarely be possible at a depth greater than what corresponds to 65 m.w. The largest numbers of the corresponding specimens of *P. sphyrænoides* were, likewise, taken with 25 m.w.; but the catch was not restricted to the use of the very small lengths of wire, as is demonstrated by the relatively large number of the smallest but one specimens taken with 300 m.w. This difference indicates that the higher temperature in the superficial layers is absolutely preferred by *P. pseudosphyrænoides thori*, whereas the occurrence of the tiny postlarvæ of *P. sphyrænoides* seems to be fairly independent of the difference in temperature between different depths, just as they are, likewise, rather independent of the differences in temperature which the seasons occasion within the areas where the occurrence is fairly common.

Although the postlarvæ of this form occur only within a limited season, and are not exposed to both of the extreme temperatures of the year, yet their geographical distribution, as shown on the chart Fig. 31 (p. 130) is somewhat restricted. Surface isotherms are noted on the chart as they prevail in August. The

fact is that the surface temperatures differ but slightly from those occurring at the small depth mentioned, corresponding to 25 m.w., in which the smallest postlarvæ are found to exist, and can thus give a good idea of the relation of the distribution to the temperature. As will be seen, the distribution of the postlarvæ, for the most part, is to be found in areas that have a higher surface temperature than 25° and is bounded by the 23°- isotherm, while postlarvæ of *P. sphyrænoides* occur, for the most part, in areas having a lower temperature than 25°. The temperatures observed by the "Thor" between the 24th of July and the 1st of August in the southerly Ionian Sea and the Levant were, at a depth of 10 meters, 24°.09—26°.05 and at a depth of 25 meters, 21°.70—24°.55.

The distribution in the Mediterranean shows that the temperature, at the depth in question, is nowhere in this sea too high for the occurrence of postlarvæ of the form under discussion, but, on the other hand, that a certain temperature minimum fixes limits in that respect. This temperature minimum is not known, as the observations of the "Thor" during summer, in the actual area of distribution, extend over only two months from the 29th of June (St. 115) to the 31st of August (St. 215); the lowest observed temperature at a depth of 10 meters is 19°.00 (St. 132). As stated, the S/S "Pangan" took a specimen in the eastern basin on the 7th of November at St. 384 and there observed a surface temperature of 18°.5.

In the beginning of September, the "Thor" found temperatures of 22°.85—23°.45 at a depth of 10 meters in the Alboran Sea. Consequently, at the hottest time of the year there would be nothing, as far as temperature is concerned, to prevent an occurrence of postlarvæ in that region. That they are nevertheless absent or, in the easterly part, very rare, must be due to the fact that the favourable period with a sufficiently high temperature is too limited in this part of the Mediterranean. A similar view must certainly also hold good as regards the absence of an occurrence in the northerly part of the western basin; thermometrical observations are, however, not available from the hottest time of the year; those that are at hand are, for the most part, lower than the minimum temperature found at St. 132.

In the Atlantic, the "Dana" took the smallest specimens of postlarvæ with 50 and 100 m.w., most with the latter; in accordance with these lengths of wire the postlarvæ, for the most part, must be assumed to occur at a depth of 25—30 meters. Unfortunately, hydrographic observations, beyond the measurements of surface temperatures, are not available from most of the stations positive for catches of this form. Only from the following stations there are measurements from different depths as well, of these, the temperatures which are of interest, in respect of the form under discussion, are given below:—

Depth	25 m.	50 m.
St. 1015	24°.61	21°.07
» 1021	23°.66	19°.85
» 1054	23°.84	23°.71
» 1057	23°.32	23°.27
» 1108	19°.79	17°.02
» 1110	?	17°.11
» 1152	22°.26	19°.83
» 1339	19°.61	19°.37
» 1356	22°.41	20°.65
» 1365	21°.26	19°.67

As will be seen, the temperatures at a depth of 25 meters lie between the extreme temperatures found at a depth of 10 meters in the Mediterranean at the stations where the form was taken. As the two depths mentioned should correspond approximately to each other, in the two respective areas of distribution, with regard to the occurrence of the smallest postlarval specimens of the form, an agreement appears

to exist between the two stocks in respect of the demands of temperature. Apropos this comparison, it may be of interest to note the extreme values of the surface temperatures observed at the stations positive for the catch of the form; they are 18°.0 (St. 770) and 27°.0 (St. 890 and 891) and consequently correspond well to those observed in the Mediterranean.

On the chart Fig. 32 which illustrates the distribution of the postlarvæ in the Atlantic — for want of an available statement as to the isotherms at a depth of 25 meters — isotherms, according

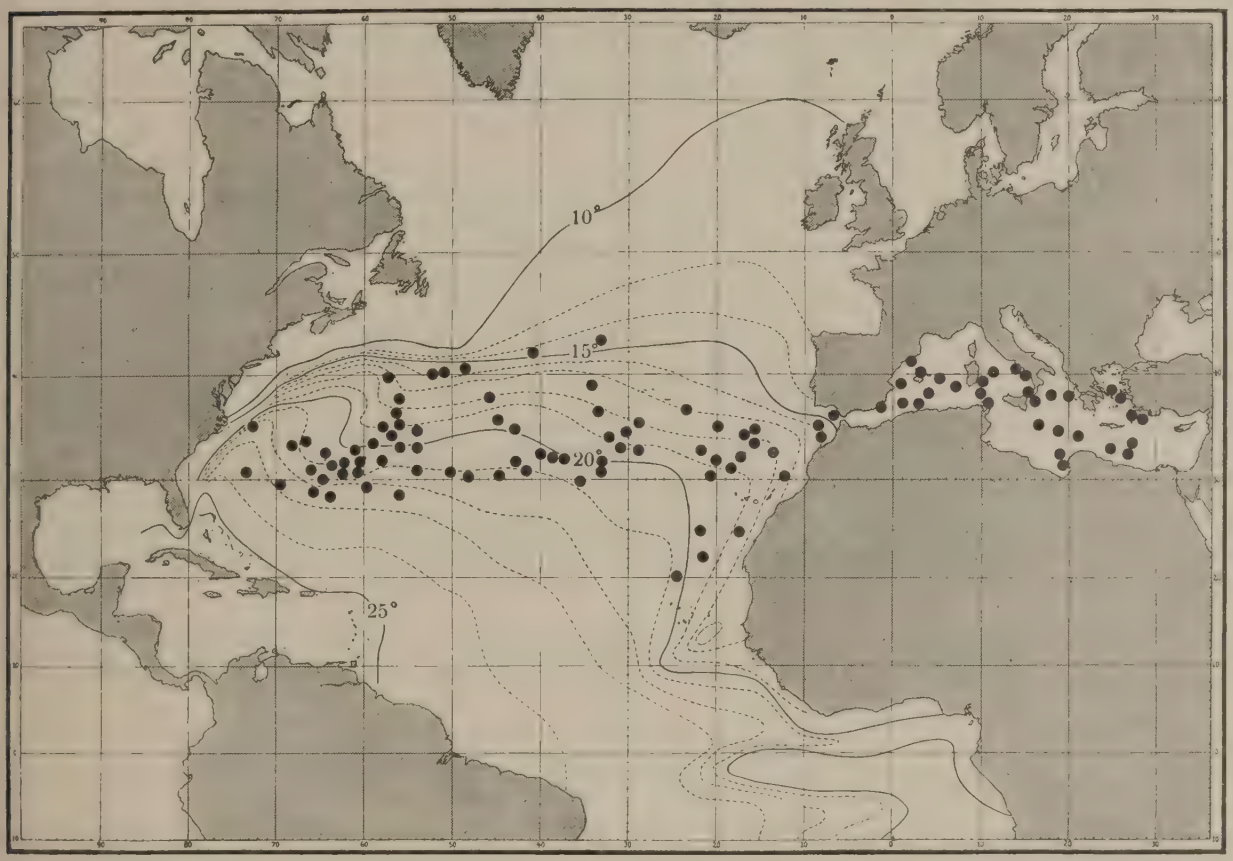

Fig. 32. Distribution of the postlarvæ of *Paralepis pseudosphyrænoides thori* Ege. The isotherms at a depth of 50 meters are indicated (after Schott 1902).

to Schott, at a depth of 50 meters have been noted, which of course indicate temperatures at the boundaries of the areas of distribution which are somewhat lower than the limiting temperatures actually are. In this connection it must be remembered that the difference between the two rather closely related forms, *P. sphyrænoides* and *P. pseudosphyrænoides thori*, in respect of their relation to the temperature, is most likely greater than the respective areas of distribution of their postlarvæ in the Atlantic would indicate.

Propagation. The occurrence of postlarvæ in the Atlantic is, as in the Mediterranean, confined to the hotter seasons. Specimens have been found only between the 9th of May (St. 1337) and the 22nd of November (St. 1057). As the area of distribution in the Atlantic, in contrast to that in the Mediterranean, at any rate as far as certain portions are concerned, has been investigated all the year round, and as the small lengths of wire, which at many of the stations were the only ones used, must be satisfactory in respect of catches of this form, we are warranted to regard the many negative results as significant and to con-

sider it likely that the two days mentioned are very near the actual seasonal limits. In the Mediterranean the absence of any occurrence may be regarded as ascertained during the months when the winter researches of the "Thor" were made, from the middle of December to the middle of February and, as regards the Straits of Messina, in March as well. It has thus been shown that the two stocks are in agreement in respect of a lack of occurrence in the coldest months.

b. PARALEPIS PSEUDOSPHYRÆNOIDES DANÆ, subsp. n.

Material. The material consists of 344 postlarval specimens all taken in the Atlantic, the majority, 290 specimens, by the "Dana" in 1921—22.

Horizontal distribution. The distribution stretches across the Atlantic in rather a narrow belt just as in the case of *P. pseudosphyr. thori*; but the entire area has a somewhat more southerly position than that of the other. This is best seen as regards the easterly part from which most of the material is derived. While the southern limit of the other form lies at about 20° N. lat., this form has been taken at three stations south of the said latitude, the most southerly lying at about 15° N. lat. As regards the northern (or north-eastern) limit, *P. pseudosphyr. thori* was taken at four stations in the Bay of Cadiz (12 specimens), while in the same locality only a single specimen of *P. pseudosphyr. danæ* (St. 1139) was found, the smallness of this catch becomes all the more apparent when it is stated that at the next station taken by the "Dana", St. 1140, north of Madeira, 98 specimens of this form were taken. The occurrence of its postlarvæ in the Bay of Cadiz must therefore be considered very rare. The southern limit in the westerly part of the area of distribution appears to lie a little more to the south than in the case of the other form; but the material is too insufficient for the slight difference in question to be more precisely determined.

Vertical distribution. The following synopsis embraces the material collected by the "Dana" between the 11th of October and the 5th of November, and between the 14th and the 23rd of May.

M.W.	25	50	100	150	200	300	400	500	>500
Number of hours	0	15	36	16½	28½	40	16	12	103
Length < 10 mm.									
Number of specimens	..	6	14	1	15	6	4	..	
No. of specimens div. by no. of hours	..	0.4	0.4	0.1	0.5	0.2	0.3		
Length 10—15 mm.									
Number of specimens	..	33	92	3	53	9	1	2	2
No. of specimens div. by no. of hours	..	2.2	2.6	0.2	1.9	0.2	0.1	0.2	0.0
Length 15—25 mm.									
Number of specimens	..	2	15	4	8	8	1	1	4
No. of specimens div. by no. of hours	..	0.1	0.4	0.2	0.3	0.2	0.1	0.1	0.0
Length 25—40 mm.									
Number of specimens	..	..	1	..	..	5			

The same number, per hour, of the smallest specimens was taken with 50, 100 and 200 m.w. The apparently divergent small number of specimens, < 15 mm. in length, taken with 150 m.w., has

been occasioned by the fact that at St. 1140—47, from which most of the specimens of this size were derived, this length of wire was not used at all. Nor is the number of specimens, 10—15 mm. in length, resulting from the use of the three lengths of wire, very different, though most of them were taken with 100 m.w. This length of wire has, likewise, given the largest number of specimens 15—25 mm. in length, while the catch with 50 m. w. compared with that of specimens of the preceding size-groups seems greatly reduced.

The distribution of the catch among the several lengths of wire is thus different in the two forms of the species. While the smallest postlarvæ of *P. pseudosphyr. thori* were taken exclusively with 50 and 100 m.w., the use of 150 and 200 m.w. seems to give about the same results as those that the smaller lengths of wire have given in the case of the form under discussion. That the catches with the greater lengths of wire actually indicate a corresponding occurrence in the deeper layers of water and do not originate from catches of specimens from lesser depths, made when hauling in the apparatus which, as we know, is a possibility always to be reckoned with when it is a question of a few specimens, seems to be confirmed by the fact that the distribution of the fairly large material of specimens, 10—15 mm. in length, among the several lengths of wire, is the same.

The difference between the two forms in respect of the vertical occurrence of the postlarvæ, particularly of the smallest specimens, may be put in connection with their appearance at, to a certain extent, different seasons. The postlarvæ of *P. pseudosphyr. thori* commonly occur also in July, August and September, while no specimen was taken between the 22nd of November and the 9th of May. Of the form under discussion no specimen was taken in the three hottest months, but catches were made from the 24th of February to the 23rd of May and also from the 11th of October to the 9th of December. Consequently, in contrast to the postlarvæ of the other form, they can occur at a time of year when the temperature at the surface and at a depth of 50 meters is approximately the same, and at a depth of 100 meters only slightly different, as *inter alia* the observations made in April at the stations positive for the catch of the form, St. 828—34, show, *viz.* at the surface, 18°.1—21°.0, at a depth of 50 m., 18°.15—20°.9 and at a depth of 100 m., 17°.85—20°.3, and they do not occur at all in the months when the difference in temperature, between the depths in question, is greatest.

Relation between vertical and horizontal distribution. In respect of the elucidation of the relation between the vertical distribution of the smallest postlarvæ and the horizontal of the postlarvæ in general, regard should be had to the temperature at the depth at which the smallest specimens most commonly occur. As stated, about equal numbers were taken per hour with 50, 100 and 200 m.w. The occurrence is thus grouped around a depth corresponding to about 125 m.w. which is confirmed by the fact that the maximum catch of the smallest but one specimens (10—15 mm.) was made with 100 m.w. In the closely related species this length of wire is, as we have seen, a little smaller than that which gives the largest catch of the smallest specimens (< 10 mm.)

If the proportion between the depth and the length of wire is reckoned as 1 to 3, the occurrence of the smallest postlarvæ may be computed to group itself around a depth of about 40 meters, while a maximum occurrence connected with a definite depth in this case is only faintly marked. On the chart, Fig. 33, which shows the distribution of the postlarvæ, isotherms are noted at a depth of 50 meters. That the 23°- isotherm at this depth indicates the average temperature of the year corresponding to the limiting temperature maximum, agrees rather well with the thermometrical observations of the "Dana" at the stations where the form was found, which in the colder season (April) gave 18°.15—20°.9 and in the hotter (October) 19°.83—25°.39. As will be seen, the average figure between the two higher values lies near 23. As the occurrence may be assumed, as explained above, to group itself around a somewhat lesser depth, it may be of interest to give the observations at a depth of 25 meters. These are not available at the stations 828—31 and 834 from which the said values of temperature, observed in April, are derived, but may indeed, like the surface tem-

peratures, have about the same values as those at a depth of 50 meters; observations made in October at a depth of 25 meters showed 21°.40 (St. 1142) as a lowest temperature and 26°.49 (St. 1160) as a highest.

By way of comparison with these figures it may be mentioned that at a depth of 25 meters at stations, where postlarvæ of *P. pseudosphyr. thori* were found, temperatures from 19°.61 (St. 1339) to 24°.61 (St. 1015) were registered, while at St. 1159, where *P. pseudosphyr. danæ* was found, so high a temperature as 25°.39

Fig. 33. Distribution of the postlarvæ of *Paralepis pseudosphyrænoides danæ*, subsp. n. The isotherms at a depth of 50 meters are indicated (after Schott 1902).

was registered even at a depth of 50 meters. Even if the ascertained highest values do not lie equally near the respective highest temperatures at which the smallest postlarval specimens of the two forms can occur, it will, however, be perceived that the temperature maximum for the occurrence of *P. pseudosphyr. danæ* can hardly lie lower than that for the occurrence of the other form. Among the surface temperatures, registered at the stations where *P. pseudosphyr. thori* has been taken, the lowest value is 18° (St. 770, on the 6th of October) and at the stations where *P. pseudosphyr. danæ* has been taken, the lowest value is 17°.5 (St. 469, on the 9th of December). Both a non-occurrence of postlarvæ of the latter form during the hottest months and an occurrence during colder seasons than those in which the postlarvæ of *P. pseudosphyr. thori* are found, may, thus, be connected with the partially more southerly position of the area of distribution of the postlarvæ of *P. pseudosphyr. danæ*.

P. pseudosphyr. danæ has not been found in the Mediterranean; the researches in this sea have not been so thorough that a non-occurrence can be ascertained, as only the investigation of the Straits of

Messina in March and April 1911 took place at a time of the year when specimens of the form have been taken in the Atlantic, though the stations of the "Dana" in the Mediterranean were taken only a few weeks in advance of the stations 1140 and 1145—47 (from the 14th—20th of October), at which a large number of specimens were found. It is, however, not likely that this form is to be found in the Mediterranean; in any case, an occurrence of postlarvæ in this sea, at the same time of the year as in the Atlantic, would be impossible on account of the low temperature of the Mediterranean in the winter.

Propagation. As stated, postlarvæ of this form were not found in the four summer months, June—September. This non-occurrence indicates an interval of rest for this period, in respect of spawning, as the westerly part of the area of distribution of the postlarvæ just at the said time of the year has been the object of an intensive research.

7. PARALEPIS AFFINIS, sp. n.

Material. The material of postlarvæ of this species is very comprehensive, consisting as it does of 5634 specimens, all taken in the Atlantic.

Horizontal distribution. The distribution of the postlarvæ of this species, like that of the last one described, stretches across the Atlantic and thus has a similar east to west expanse here. On the contrary the distribution from north to south is quite dissimilar. Whereas the postlarvæ of the two forms of *P. pseudosphyrœnoides* were found only in relatively narrow belts embracing 10 to 15 degrees of latitude, the area of distribution of the postlarvæ of *P. affinis* reaches from a northern limit, situated not very differently to that of *P. pseudosphyr. thori*, to south of the equator. The northern limit lies, in the westerly area at about 40° N. lat., in the easterly at about 34° N. lat., towards the south the species has been taken up to about 7° S. lat. (by the S/S "Texas", St. 748). Nothing can, however, be said as to the position of the southern limit. Some stations have, to be sure, been taken at positions more southerly than that mentioned, but considering that only a very small fraction of the number of stations within the area of distribution of the species, taken by other than research vessels, has given positive results, no great significance can be attributed to the negative results at these southerly situated stations.

On the chart, Fig. 34, which shows the distribution of the postlarvæ, the greater or less degree in which the different areas are furnished with symbols, indicating positive stations, must not in all cases be taken to denote a corresponding more or less common occurrence of the postlarvæ of the species but, as regards most of the portions, only the result of the nearer or farther situation of the stations from one another. The area between about 20° and 30° N. lat. and between about 45° and 65° W. long. has thus been investigated with particularly great intensity, while the large area south of 20° N. lat. and between 30° and 60° W. long. has been examined very little, if the single row of stations of the "Dana" is excepted. Furthermore it should be remarked that no researches have been made in the Gulf of Mexico.

Vertical distribution. The following synopsis embraces the material collected during the cruise of the "Dana" in 1921—22, between the 14th of October and the 9th of June:—

M.W.	25	50	100	150	200	300	400	500	>500
Number of hours	2	138¼	195¼	40½	85¼	217¼	51¼	50½	922
Length < 10 mm.									
Number of specimens	..	..	3	8	124	67	11	3	6
No. of specimens div. by no. of hours	..	..	0.0	0.2	1.5	0.3	0.2	0.1	0.0

M. W.	25	50	100	150	200	300	400	500	>500
Length 10—15 mm.									
Number of specimens	..	9	161	68	149	110	12	9	37
No. of specimens div. by no. of hours	..	0.1	0.8	1.7	1.7	0.5	0.2	0.2	0.0
Length 15—25 mm.									
Number of specimens	..	52	302	165	239	157	20	5	47
No. of specimens div. by no. of hours	..	0.4	1.5	4.1	2.8	0.7	0.4	0.1	0.1
Length 25—40 mm.									
Number of specimens	..	13	107	36	79	81	4	6	21
No. of specimens div. by no. of hours	..	0.1	0.5	0.9	0.9	0.4	0.1	0.1	0.0
Length > 40 mm.									
Number of specimens	..	..	3	4	3	17	4	3	6
No. of specimens div. by no. of hours	..	..	0.0	0.1	0.0	0.1	0.1	0.1	0.0

The smallest specimens have, to a marked degree, been taken mostly with 200 m.w., as five times as many, per hour, have been taken with this length of wire as with the length, 300 m., that has given the largest result but one. A slightly smaller number than that taken with the latter length seems to have been taken with 150 and 400 m.w. The catch with 100 m.w. is quite negligible and with smaller lengths of wire no specimen at all has been taken. Of specimens of the next size, 10—15 mm. in length, the greatest numbers, approximately equally large, have been taken with 150 and 200 m.w.; the number taken with 100 m.w., which is half as large as with the said lengths of wire, is appreciably larger than what has been obtained with 300 m.w. Individual specimens have been caught with 50 m.w. Specimens 15—25 mm. in length have likewise been taken mostly with 150 and 200 m.w., but yet in a greater number with the former length of wire. With 100 m.w. twice as many have been taken as with 300 m.w. The catch with 50 m.w. is larger than it was as regards the smaller specimens, amounting, as it does, to about a third of what the use of 150 m.w. has given. The distribution of the specimens of the next size-group (25 – 40 mm.) among the different lengths of wire does not differ much from that of specimens 10—15 mm. in length. Of both sizes about an equal number has been taken with 150 and 200 m.w. This shifting from greater to lesser depths, during the growth of the postlarvæ, which has been observed in the case of the fairly young specimens, in respect of the level of the maximum occurrence, seems thus to cease, at any rate before the postlarvæ reach a size of 40 mm., and a reverse movement to take its place. The material of specimens larger than 40 mm., however small it is, seems to confirm this, as about equal numbers of specimens have been taken with 150, 300 and 400 m.w.

Thus, this species differs in a high degree, also in respect of the vertical distribution of the postlarvæ, from *P. pseudosphyrœnoides*, of which the smallest specimens, in the case of *P. pseudosphyr. thori*, were taken with 100 and 50 m.w. and, in the case of the other form, in about the same number with these smaller lengths of wire as with 200 m.w.

Relation between vertical and horizontal distribution. If the proportion of the length of wire to the depth is as 3 to 1, the depth for the most common occurrence of the smallest specimens, < 10 mm. in length, is calculated to be somewhere about 70 meters, in accordance with the fact that the largest number to so pronounced a degree has been taken with 200 m.w. On the chart, Fig. 34, which shows the distribution of the postlarvæ, there have, in the absence of any indication of the course of the isotherms at this depth, been noted, according to SCHOTT, the isotherms at a depth of 100 meters, as the thermometrical observations of the "Dana" at the depth of 75 meters, in a stretch where the conditions differ so widely at the depths of 50 and 100 meters, *viz.* the section between the Cape Verde Islands and

St. 1171, generally show values very near to those indicated by SCHOTT's isotherms at a depth of 100 meters and do not correspond at all to the conditions at the depth of 50 meters. The thermometrical observations of the "Dana" at a depth of 75 meters at St. 1160—71 are as follows:—

Fig. 34. Distribution of the postlarvæ of *Paralepis affinis*, sp. n. The isotherms at a depth of 100 meters are indicated after SCHOTT 1912, the 20°- isotherm is also after SCHOTT 1902 and is marked with a broken line with dots.

St. 1160 — 19°.77
» 1162 — 16°.82
» 1164 — 21°.85
» 1165 — 18°.30
» 1166 — 16°.76
» 1169 — 19°.66
» 1171 — 19°.83 and 20°.97.

The isotherms, noted on the chart, reproduce SCHOTT's more recent representation in his geography of the Atlantic (1912, 2nd ed. 1926); his older representation in the report of the "Valdivia" expedition, however, agrees better with the observations of the "Dana" of the temperature at a depth of 100 meters in respect of the course of the 20°- isotherm in the southerly part of the area embraced by the attached chart; therefore both SCHOTT's representations of the course of this isotherm are marked here. As regards the northerly part of the region between 30° and 40° N. lat. no fundamental difference prevails at a depth of 50 and 100 meters in respect of the course of the isotherms. The difference in that respect represents

practically a parallel shifting. It will thus be seen from SCHOTT's chart that the 15°-isotherm at a depth of 100 meters has, with trifling divergences, the same geographical position as the 17°-isotherm at a depth of 50 meters. In the westerly part of the region between 20° and 30° N. lat. matters are likewise related, only there is, in the hotter parts, a slighter difference between the two depths, thus the 24°-isotherm along the north-easterly border of the Bahama Islands at a depth of 100 meters corresponds quite well with the 25°-isotherm at a depth of 50 meters. As regards the areas mentioned, the isotherms at a depth of 100 meters used in this chart of the distribution of the postlarvæ must, then, give a good idea of the relation of the several parts to one another in respect of the temperature, at a depth of 75 meters as well, a circumstance which is of importance in the following consideration of the relation between the populations of this species in different localities.

As to the relation between the vertical occurrence of the smallest specimens of postlarvæ and the horizontal distribution of the postlarvæ of the species in general, the connection is not immediately evident. For it cannot be shown that a temperature maximum exists for the occurrence of postlarvæ, as they are to be met with in portions of the North Atlantic, the Caribbean Sea and the Straits of Florida, which also, at the depth in question, are the hottest, and thus a limitation arising from a high temperature, unfavourable to the occurrence of the smallest postlarvæ of the species, cannot be pointed out. The extreme values of the thermometrical observations of the "Dana", at a depth of 75 meters, at stations where postlarvæ of this species have been taken, are 16°.76 (St. 1166) and 26°.85 (St. 1185). The low extreme temperature observed at St. 1166, one of the mentioned series of stations taken by the "Dana" between the Cape Verde Islands and the coast of Guiana, evidently lies near the actual minimum for the occurrence of the smallest postlarvæ, to judge from the temperature prevailing at a depth of 100 meters at the northern limit of the area of distribution.

Propagation. Postlarval specimens, <10 mm. in length, were met with in all months except August and September, <15 mm., in all months except August. Thus, the species can hardly be said to have any non-spawning period, at any rate it can only be a very short one.

8. PARALEPIS THERMOPHILUS, sp. n.

Material. The material consists of 1521 specimens which are postlarval (with the exception of a single adolescent). By far the predominating number, about 1400 specimens, were collected by the „Dana" in 1921—22.

Horizontal distribution. The distribution of the postlarvæ in the North Atlantic is, except for an isolated occurrence, confined to the south-westerly part of this region, stretching in a rather narrow belt from the equator to about 35° N. lat. The middlemost portion of this area has its greatest extent in an east to west direction, for besides a narrow strip north-east of the Antilles, it embraces the Caribbean Sea and the Straits of Florida, while the area to the north has the narrowest extent. The isolated occurrence referred to was found at St. 1159 near the Cape Verde Islands. The material affords but little information regarding the distribution in the South Atlantic; the species was taken at two stations near the equator and at about 21° S. lat. off the coast of America.

Vertical distribution. The following synopsis of the distribution of the catches among the different lengths of wire includes the main material collected by the "Dana" between the 29th of October 1921 and the 21st of May 1922.

M.W.	0	25	50	100	150	200	300	400	500	600	>600
Number of hours	16½	2	108	130	4	8	132	4	15	130½	349½
Length < 10 mm.											
Number of specimens	..	1	47	158	..	2	13	..	..	...	1
No. of specimens div. by no. of hours	..	..	0.4	1.2	..	0.3	0.1	..	..	..	..
Length 10—15 mm.											
Number of specimens	..	1	218	271	..	9	46	..	1	8	17
No. of specimens div. by no. of hours	..	..	2.0	2.1	..	1.1	0.3	..	..	0.1	0.0
Length 15—25 mm.											
Number of specimens	..	..	157	180	..	33	160	..	5	18	10
No. of specimens div. by no. of hours	..	..	1.5	1.4	..	4.1	1.2	..	0.3	0.1	0.0
Length 25—40 mm.											
Number of specimens	..	..	..	4	..	..	25	..	1	5	1
No. of specimens div. by no. of hours	..	..	..	0.0	..	..	0.2	..	..	0.0	..

The largest number of the smallest specimens were taken with 100 m.w., the catch per hour with this length of wire is three times as large as that with 50 m.w., which has given the largest result but one, and five times as large as that with 200 m.w. It may furthermore be added, as it does not appear in the synopsis, that the 29 smallest specimens, 5—7 mm. in length, were all taken with 100 m.w. No specimen whatever was taken with 150 m.w., a circumstance to which no significance can be attached owing to the very restricted use of this length of wire at the stations where postlarvæ of the species were taken. The question might arise as to whether there had not been a possibility of getting the same number with 150 m.w. as with 50 m.w. or, contingently, a larger number, had these lengths of wire been used to the same extent. The distribution of the smallest specimens but one (10—15 mm.) among the different lengths of wire can give a good idea of the matter. We have learned from experience that as regards other species (for instance *P. pseudosphyrænoides* and *P. affinis*) the length of the wire that gives the largest catch is about 25 meters smaller for the catch of specimens 10—15 mm. in length than for the catch of the smallest specimens, less than 10 mm. Of the present species equal numbers of specimens were taken with 50 and with 100 m.w. One cannot, therefore, be far wrong, if one, as regards the smallest specimens, reckons 100 meters as the approximately average length of wire. The small number taken with 300 m.w. is a perfectly valid expression of the very scanty occurrence at the depth this wire represents, as fishing with this length of wire was carried on for just as many hours as with 100 m.w.

Of specimens, 10—15 mm. in length, about equal numbers were taken per hour with 50 and with 100 m.w., a little more than half as many with 200 m.w., while the number caught with 300 m.w. amounts to about 1/7 of the two largest numbers. Specimens 15—25 mm. in length were taken in about the same numbers with 50, 100 and 300 m.w., in a larger number with 200 m.w., no great significance can, however, be attached to this last result nor to corresponding result as to the other size-groups, this length of wire having been used for so few hours. The numbers obtained by the greater lengths of wire, 500 and 600 meters, are somewhat larger than those of the smaller specimens and were thus, perhaps, derived partly from the depths these lengths of wire represent. The catch of the largest specimens is very differently distributed among the three lengths of wire in question, 50, 100 and 300 meters, as the principal catch was taken with 300 m.w. and nothing at all with 50 m.w. Though the whole number is small this great difference could hardly have occurred by chance. As in the case of other species, a shifting from a greater to a lesser depth thus takes place during the growth of the postlarvæ which, when a certain stage is reached, is succeeded by a movement in the opposite direction.

Relation between vertical and horizontal distribution. The smallest specimens, < 10 mm. in length, were for the most part taken with 100 m.w. Reckoning, as before, the proportion of the length of wire to the depth as 3 to 1 the common occurrence of specimens of this size should be found at a depth of about 33 meters. On the chart, Fig. 35, which shows the distribution of the postlarvæ, there have, in the absence of a representation of the isotherms at this depth, been

Fig. 35. Distribution of the postlarvæ of *Paralepis thermophilus*, sp. n. The isotherms at a depth of 50 meters are indicated (after SCHOTT 1902).

noted those at a depth of 50 meters. The agreement between the confinement of the horizontal distribution in the North Atlantic — with the exception of the isolated occurrence at St. 1159 — to a comparatively narrow belt in its south-westerly part and the temperature is, as regards the middlemost and southerly parts of the area of distribution, elucidated quite well by SCHOTT's isotherms, even though the depth is a little greater than that at which the specimens of the smallest postlarvæ are, for the most part, assumed to occur. The apparent lack of agreement indicated by the occurrence north of 30° N. lat. is due either to a mistake in SCHOTT's representation or to very changeable conditions in this area; at any rate the "Dana" in May 1922, at which time specimens were taken at two of the northerly localities, observed at St. 1347 and 1351, situated at about 36° N. lat. and about 74° W. long., temperatures of 25°.59 and 26°.06 respectively, at a depth of 50 meters.

The extreme values of temperature, registered at the stations where the postlarvæ of the species were taken, are:—

Depth	25 m.	50 m.
	23°.42 (St. 1239)	23°.35 (St. 1239)
	and 27°.71 (St. 1178)	and 27°.60 (St. 1186).

Even at a depth of 50 meters there are, besides the locality mentioned, only two stations positive for the catch of postlarvæ of the species, from which observations are available (St. 1174 and 1238), where temperatures lower than 24° have been registered. Thus, as regards this species, the temperature minimum for the occurrence of the youngest postlarvæ is particularly high, a circumstance which is confirmed by the isolated occurrence of postlarvæ at station 1159. For this locality also occupies or, at any rate, did so at the time the specimens were taken, an isolated position in respect of temperature, as this is the same from the surface to a depth of 50 meters and thus at this depth reaches a value which in the North Atlantic, except in this locality, is found only in the south-westerly part, to which part, as stated, the distribution of postlarvæ of the species is otherwise confined.

Below are the temperatures registered by the "Dana" at a depth of 50 meters at St. 1156—72, the last named being the most north-easterly of the few stations in the series between the Cape Verde Islands and South America at which postlarvæ of the species were taken:—

St. 1156 — 22°.33
» 1157 — 22°.15
» 1159 — 25°.39
» 1160 — 21°.83
» 1162 — 19°.77
» 1164 — 23°.06
» 1165 — 24°.46
» 1166 — 22°.88
» 1169 — 22°.18
» 1171 — 24°.76
» 1172 — 26°.22.

The agreement between the temperature and the occurrence is at once to be seen. Whereas the temperature at a depth of 25 meters does not give any explanation of the isolated occurrence, as it is lower at St. 1159 than at any of the subsequent stations. Either the state of the temperature at the depth which must be assumed to be the approximate one for the common occurrence of the smallest postlarvæ, about 33 meters, is nearer to what exists at a depth of 50 meters, or it is possible that it is not exactly the state of things at the depth where the tiny postlarvæ occur, but what exists at a slightly greater depth that is to be taken into consideration.

Propagation. Small postlarval specimens, < 15 mm. in length, were taken in the months of January—June, and also in November and December. No researches were made in August and September within the area of distribution. It may then be laid down that at any rate spawning takes place the greater part of the year.

9. PARALEPIS INTERMEDIUS Poey (?).

Material. The material consists of 479 postlarvæ, which, with the exception of three specimens, were collected during the cruise of the "Dana" in 1921—22.

Horizontal distribution. The geographical distribution of the postlarvæ in the North Atlan-

tic is about the same as that of the preceding species. With but a few exceptions it is likewise limited to a rather narrow area in the south-westerly part, including the Caribbean Sea, stretching towards the north to about 35° N. lat. As was the case with the preceding species, an isolated occurrence was found north of the Cape Verde Islands (St. 1159); but besides this an individual specimen was taken at about 6° N. lat. and about 27° W. long. As regards a possible distribution in the South Atlantic no information is available owing to a want of material.

Vertical distribution. The distribution of the catches among the different lengths of wire is to be seen in the following synopsis:—

M.W.	0	25	50	100	150	200	300	400	500	600	>600
Number of hours	10½	2	71⅓	81	2	4	79	0	12	77⅓	192
Length < 10 mm.											
Number of specimens	..	..	1	37	1	1	4	..	..	1	..
No. of specimens div. by no. of hours	..	..	..	0.5	..	..	0.1	..	..	..	..
Length 10—15 mm.											
Number of specimens	..	..	45	113	..	33	12	..	..	4	1
No. of specimens div. by no. of hours	..	..	0.6	1.4	..	..	0.2	..	..	0.1	..
Length 15—25 mm.											
Number of specimens	..	..	38	59	2	22	66	..	1	7	1
No. of specimens div. by no. of hours	..	..	0.5	0.7	..	..	0.8	..	..	0.1	..
Length 25—40 mm.											
Number of specimens	..	..	..	2	..	..	14	..	..	1	..
No. of specimens div. by no. of hours	..	..	..	0.0	..	..	0.2	..	..	..	..

As will be seen from a comparison of the above synopsis with the corresponding one of the preceding species, the vertical distribution of the postlarvæ of the two species is practically the same. The smallest specimens, < 10 mm. long, of this, like those of the preceding species, were, for the most part, taken with 100 m.w. though to a more noticeable extent, as the catches with 50 m.w. and with 300 m.w. are quite negligible. Of the results achieved with lengths of wire less than 500 m. only those with the three lengths named give any reliable indication of the proportion between the numbers of specimens at the corresponding depths, as the other lengths were so little used and the proportional size of the catches may be quite accidental. What the relation is between 150 m.w. and 100 m.w. in respect of catches of the smallest postlarvæ does not thus appear directly. Of specimens 10—15 mm. in length more than twice as many were taken with 100 as with 50 m.w.; in accordance with the relation mentioned between the two smallest size-groups of the preceding species, it must be assumed that by using 150 m.w. about the same number of specimens, < 10 mm. in length, might be taken as with 100 m.w. In both size-groups the number which the use of 300 m.w. has given is only about 1/10 of that obtained by 100 m.w., while as regards the subsequent size-groups the use of the three lengths of wire, as was also the case with the preceding species, has given catches of about equal size, the smallest being with 50 m.w., as among the three lengths of wire, specimens, > 25 mm. in length, seem, for the most part, to be taken with 300 m.w.

Relation between vertical and horizontal distribution. The smallest specimens, < 10 mm. in length, were taken chiefly with 100 m.w.; as explained above, there is reason to assume that, had 150 m.w. been employed to the same extent, an equally large number would have resulted. Reckoning in

the same proportion as before, the common occurrence of specimens of this size must be placed at a depth of about 40 meters. On the chart, Fig. 36, which shows the distribution of the postlarvæ, isotherms are noted at a depth of 50 meters (according to SCHOTT). As already stated, the distribution is, on the whole, the same as that of the postlarvæ of the preceding species, also in respect of the isolated occurrence north of the Cape Verde Islands, so that the considerations advanced, when discussing that species, regarding the agreement between the distribution and the temperature at a depth of 50 meters,

Fig. 36. Distribution of the postlarvæ of *Paralepis intermedius* Poey (?). The isotherms at a depth of 50 meters are indicated (after SCHOTT 1902).

may, for all practical purposes, be considered to hold good as regards this species as well. Mention, however, must be made of the catch of individual specimens at two localities where the other species was not taken and where the occurrence does not seem to be in agreement with the conditions of temperature. Unfortunately, hydrographical observations at the two stations in question, St. 723 and 1168, are not available. To how high a degree, however, the catch of an individual specimen is an indication of a rare occurrence, should be evident, as far as the latter station is concerned, from the fact that at the nearest positive station of the "Dana", St. 1172, which is fairly neighbouring, 100 specimens were taken with the same length of wire and in the same time.

Propagation. Small postlarval specimens, < 15 mm. in length, were taken in the months of January—May and also in November and December, specimens, < 25 mm. in length, in July and October as well.

B. SUMMARY.

As the preceding account of the geographical and biological conditions will have shown, the horizontal distribution of the postlarvæ of the individual species is generally rather limited. Very little is known regarding the occurrence of the adult specimens and, in the case of some species, nothing at all. It has, however, been established as regards an individual species, *P. brevis*, that it can, at any rate as a rare exception, occur far beyond the greatly restricted area of the postlarvæ. That a similar state of things exists in the case of other forms (*P. rissoi krøyeri* and *P. coregonoides borealis*) is probable though not proved.

In considering the geographical distribution of the postlarvæ in relation to the external factors, the greatest regard has been paid to the most important portion of the material from a biological point of view, the youngest postlarval specimens. As regards all species an agreement has been found to exist between the temperatures in which these youngest postlarvæ approximately have been found, for the most part, to occur and the limitation of the horizontal distribution of the postlarvæ in general.

As the temperature besides being contingent upon the geographical position is also contingent upon the depth and, regarding the superficial layers, upon the season, and as the youngest postlarvæ of the individual species act differently in respect of the two latter components, dependence on the temperature is indicated in various ways by the different species. As regards the more northerly species particular stress is laid upon the investigation of the state of things in the Mediterranean, as the conditions of these species in the Atlantic are deficiently elucidated, there being no representative material from the winter months and the ascertained northerly limitations differing, possibly, greatly from the actual.

A reminder is first to be given regarding the conditions of *P. rissoi rissoi*, as to which form the temperature, within comparatively great differences of depth, seems to be the one only determining factor for the occurrence of the youngest postlarvæ. In the Mediterranean stock a considerable difference is apparent in respect of the vertical distribution during the summer and the winter, particularly of the smallest and the smallest but one specimens. During the winter these are taken in about equal numbers with lesser and greater lengths of wire (the latter 300 m.), while in the summer the catches with the lesser lengths are quite insignificant. Unfortunately, the smallest specimens, which from a biological point of view are the most important, are few in number, yet their occurrence, during winter both near the surface and further below, during summer, only further below, agrees with that of the smallest but one specimens. The most obvious explanation of these facts is, that there is a certain connection between a maximum temperature, which can hardly be much higher than the surface temperature during winter, and the limitation of the vertical occurrence of the youngest postlarval specimens. This particular depth occurrence during the hot season agrees with the fact that the postlarvæ are distributed over the whole of the Mediterranean despite the great differences of temperature between its several areas.

Material taken during the winter in the Atlantic, is lacking. The distribution towards the south seems to be limited by the temperature at the depth to which the occurrence of the smallest postlarvæ must approximately be assigned, this limiting temperature seems to be about the same as the highest that occurs in the Mediterranean at the stations and depths where the youngest postlarvæ were found.

The same state of things seems to prevail in respect of the other form of the species, *P. rissoi krøyeri*, but the winter material is unfortunately very limited and there are no specimens less than 10 mm. available.

In the case of *P. coregonoides coregonoides* matters are rather different, though at first sight they appear to resemble those of the first type. Thus the horizontal distribution of the postlarvæ is about the same as that of *P. rissoi rissoi* in the Mediterranean, and the smallest specimens occur both winter and summer. The vertical distribution of the form is, in part, the same as that of *P. rissoi rissoi*. In both instances the use of 25 m.w. has, in summer, given no catch or, in proportion to the aggregate number of specimens,

quite an insignificant one, of the smallest sizes (up to 15 mm.), while the winter material does not reveal such a deficient or very scanty occurrence of specimens of the same size in the superficial layers of waters, at that time of the year. In other respects the two forms are, however, different. In summer the use of 65 and 300 m.w. gives the same number of specimens, 10—15 mm. in length, of *P. coregonoides coregonoides* per hour, whereas, of the other form, no specimen has been taken with 65 m.w. The winter material also presents a great difference. While the catch of *P. rissoi rissoi* during the winter seems somewhat independent on which of the three lengths, 25, 65 and 300 m., is used, it is, as regards the smallest specimens of the other form, to a pronounced degree connected with the use of 25 m.w.

The difference found between the two forms must, in the first instance, be explained by the existence of a different adjustment as to the temperature, as the upper limit of temperature for the common occurrence of the youngest postlarvæ must be assumed to correspond approximately with the summer temperature in the uppermost layers of water in which these youngest specimens occur at that time of the year. This regard for the temperature does not, however, explain the difference as to the vertical distribution during the winter. The concentrated occurrence of the youngest specimens of *P. coregonoides coregonoides* near the surface in winter shows a dependence on the depth which asserts itself when the difference in temperature between the depths in question approximately ceases to exist.

The different vertical occurrence, summer and winter, of the youngest postlarvæ may, as in the case of the first mentioned form, explain that the horizontal distribution of the postlarvæ stretches over the greater portion of the Mediterranean; but the upper limit of temperature must be assumed to lie somewhat higher.

The available material of the Atlantic form taken during the winter months is insufficient to elucidate its relation, in a biological respect, to that of the Mediterranean. A parallelism seems to exist between the southerly limitation of the area of distribution of the postlarvæ and the isotherms at the depth to which the common occurrence of the tiny postlarvæ must approximately be referred.

While in the case of the forms discussed a regard for the temperature has displayed itself in a sinking of the level during the hot time of the year, such a change of level does not seem to play any important part in the case of the other forms in the Mediterranean, *P. sphyrænoides* and *P. pseudosphyrænoides thori*. Of these, *P. sphyrænoides* presents conditions which, however different they are from those mentioned above, must likewise be construed as an indication of the presence of a certain temperature maximum for the occurrence of the tiny postlarvæ, whereas, in the case of the other form, the limitation, both as to season and place, of the occurrence is due to the presence of a temperature minimum for this occurrence.

The postlarvæ of *P. sphyrænoides* are lacking, at any rate during the summer in the hot parts of the Mediterranean, *viz.* the greater part of the eastern basin south of about 37° N. lat. and east of about 16° E. long. and in the waters around the Balearic Isles. Postlarvæ are found both summer and winter, but there is no fundamental difference in respect of their vertical distribution in the two seasons, the smallest and smallest but one specimens being taken in summer in at least equally large numbers with 25 m.w. as with greater lengths of wire. Consequently, it must be concluded that the temperature in the layers near the surface, contrary to what must be assumed to be the case as regards the two previously mentioned forms, does not even during the summer, within the greater part of the ascertained horizontal area of distribution of the postlarvæ in the Mediterranean, exceed the maximum for the occurrence of the tiny postlarval specimens, and that this is thus possible within wider ranges of temperature. That the temperature does, nevertheless, act as a limiting factor ought to be obvious from the horizontal limitation of the postlarval area, which exists at any rate in the summer, as this limitation precisely must be considered in connection with the vertical occurrence of the postlarvæ in the hot season, especially that of the smallest specimens. In the areas mentioned where the non-occurrence of postlarvæ, at this time

of the year, has been established there would, as far as temperature is concerned, be favourable conditions for an occurrence during the winter. Owing to the lack of research this matter cannot be settled.

The species is also found in the Atlantic. Unfortunately, the material taken there is too deficient to afford any reliable basis for the determination of the level for the occurrence of the smallest specimens whereby an elucidation of the relation between vertical and horizontal distribution is rendered difficult, and a comparison of the limits of temperature for the occurrence of postlarvæ in the two regions is precluded.

The horizontal occurrence of the postlarvæ of *P. pseudosphyrænoides thori* is very different to that of the other species, as it takes place precisely in the hot parts of the Mediterranean mentioned but not in the cold parts, *viz.* north of about 41° N. lat. and in the Alboran Sea.

In accordance with this adjustment to the temperature, different as it is to that of the forms previously mentioned, there is, in the first place, the particular circumstance that the postlarval specimens have not been taken and most likely do not occur during the winter months in which researches have been carried on, in any case in the western basin and the northerly portion of the Ionian Sea, secondly, that the vertical distribution of the smallest specimens agrees with this seasonally limited occurrence. The smallest and the smallest but one specimens are with but few exceptions taken with the small lengths of wire, which indicates that the higher temperature in the superficial layers is what this form absolutely prefers, while the occurrence of the tiny postlarvæ of *P. sphyrænoides* seems to be independent on the difference between the temperatures in the superficial and the deeper lying layers.

The distribution of the postlarvæ of this form in the Atlantic stretches across the ocean in rather a narrow belt, and the occurrence is, as in the Mediterranean, confined to the hotter seasons. The vertical occurrence of the youngest postlarvæ must, for the most part, be assumed to be at a depth of 25 to 30 m., and in the Mediterranean to lie closer to the surface, at a depth of about 10 m. The temperatures, registered at a depth of 25 meters at the stations in the Atlantic where the form has been taken, lie between the extreme temperatures registered at a depth of 10 meters at corresponding stations in the Mediterranean. As these two depths may be said to correspond approximately to each other in the two respective areas of distribution in respect of the occurrence of the smallest postlarvæ, a further confirmation is to be seen of the connection between the horizontal distribution of the postlarvæ and the conditions of temperature for the occurrence of the youngest specimens.

The distribution of the postlarvæ of the other form of the species, *P. pseudosphyrænoides danæ*, which is found only in the Atlantic, is similar, though somewhat more southerly. But the seasonal limitation of the occurrence is rather different, not a single specimen having been taken during the three hottest months of the year. As regards the vertical occurrence the use of 150 and 200 m.w. seems to give about equally as many specimens of the smallest postlarvæ as the use of 50 and 100 m.w., whereas in the case of the other form the smallest specimens were taken exclusively with the latter lengths of wire. This difference between the two forms is in agreement with what is mentioned above in respect of the seasonal limitation.

Of the fifth Mediterranean species, *P. speciosus*, there is too little material to admit of its biological relations being more fully elucidated.

The four remaining species occur only in the Atlantic where directly comparable material has not, as in the Mediterranean, been collected during the seasons that differ most in regard to the temperature. Yet so large a part of the year is represented that the material is fairly suited to the elucidating of the biological conditions.

It holds good of all the species that no alteration of the level for the common occurrence of the youngest postlarvæ takes place, in any case, within the respective seasonal limitations for the research of the areas of distribution of the individual species. From the three hottest months, July, August and September, there is no material available which can be compared directly with that from other seasons,

but it is not likely that the level can be otherwise in these months. For, in contrast to the state of things with the previously discussed species, such a stability does not involve essential differences between the conditions of temperature at the different times of the year, a circumstance which, as regards the two species *P. brevis* and *P. affinis*, is due to the relatively deep position of the level, and as regards the others, to the geographical position of the postlarval area of distribution as this stretches over regions where the difference of temperature at different times of the year is slight. In both cases it must consequently be assumed that the occurrence of the tiny postlarvæ is dependent on a certain depth just as well as on the temperature, and we are debarred from determining which factor predominates.

The relation between the horizontal distribution of the postlarvæ and the conditions of temperature of the youngest specimens ought to be easy to investigate in the case of these species, as the limits of the area of distribution should, if dependence is present, run parallel with the isotherms at the practically invariable depth where the youngest postlarvæ, for the most part, occur. In the case of *P. brevis* this agreement is distinctly to be perceived both with regard to the limiting maximum and minimum temperatures, the latter being marked both as a northerly and a southerly limit in consequence of the low temperature prevailing also south of the ascertained area of distribution, at the depth, about 150 meters, to which the occurrence of the youngest postlarvæ must be assigned.

In the case of the other three species the agreement can be established only in respect of the limiting temperature minimum, as the hottest part of the North Atlantic, at the depth under consideration, the Caribbean Sea, is included in the area of distribution. This circumstance is, as regards *P. thermophilus* and *P. intermedius* (?), a natural consequence of the temperature minimum lying particularly high for these two species, while as regards *P. affinis* it is an indication of the existence of wider limits of temperature than in the case of most of the other species. According to the observations of the "Dana" there is, at the stations positive for the species, a difference in temperature, at the depth under consideration, 75 meters, of about 10°; a corresponding difference is for instance as regards *P. brevis* only of about 6°.

Among the other species of the genus a fairly great difference in temperature is found only in the case of *P. sphyrænoides*, this species, even within its limited area in the Mediterranean, being exposed to about the same differences in temperature as *P. affinis* with its widely extended distribution.

In the case of the two species, the distribution of which in the North Atlantic is otherwise confined to the hot south-westerly portion of it, an isolated occurrence has been found off the Cape Verde Islands in agreement with an existing locally limited high temperature at the depth under consideration.

The connection, which has thus been shown to exist in respect of all the species, however different they may be, between the temperature at the depth, to which the most common occurrence of the youngest postlarvæ must approximately be assigned, and the horizontal distribution of the postlarvæ in general, shows that it is the state of things at this or at an adjacent depth that must be taken into consideration. Another point is that it is far from thereby being a positive fact that it is precisely these tiny postlarvæ which can occur only within the ascertained limits of temperature. It is fairly probable that the concentrated occurrence of the tiny postlarvæ is an indicator of the depth at which the spawning takes place, and that this depth is the same as, or very close to, that of the said occurrence. If, on the contrary, the spawning takes place at a very divergent depth, the said agreement must be an indication of the dependence of the postlarvæ on the temperature, and their horizontal distribution is then hardly congruent with the spawning area, it cannot at any rate be so if the temperature is a limiting factor for this as well. The existence of a fairly great difference between the two areas is not likely.

IV. VALUATION OF THE LEAST FOUND SYSTEMATICAL UNITS OF THE GENUS.

As will be remembered, when stating the reasons for the dividing up of the three species, *P. Rissoi*, *P. coregonoides* and *P. pseudosphyrænoides*, into two separate forms, subspecies, particular weight was laid on the ascertained difference with regard to the respective numbers of vertebræ. The difference between the average values of the figures of vertebræ is, in *P. Rissoi* 3.73, in *P. coregonoides* 3.1 (as regards the figures of myomeres 2.89) and in *P. pseudosphyrænoides* 2.96. As a criterion for the size of these differences it may further be stated that no variate has been found in *P. Rissoi* common to the two forms, one in *P. pseudosphyrænoides* and two (figures of myomeres) in *P. coregonoides*. The essential in respect of these differences, however, is not the sizes themselves — as will be shown below, an equally great difference can be found within a species, the existence of which, however, does not justify a subdivision of the investigated species in question — but the sharp mutual demarcation of the forms in respect of the number of vertebræ and the very limited, or perhaps the entire absence of, alteration of this according to the locality. In this connection the state of things must be mentioned as to the occurrence of the two forms of *P. pseudosphyrænoides*, which for the greater part have the same horizontal area of distribution and partly the same seasonal appearance of the postlarvæ and seem to be approximately the same in respect of their relation to the temperature, while between specimens from the Atlantic and from the Mediterranean of the one form, *P. pseudosphyrænoides thori*, no difference of any importance has been found; furthermore it must be borne in mind that in respect of *P. coregonoides borealis*, between the most northerly population within the ascertained area of distribution of the postlarvæ, in the waters south-west of Ireland, and the most southerly one within the area, near Madeira, it has not been possible to point out any difference greater than what might be due to an insufficiency of material.

By way of comparison with these facts there will be given the result of a more thorough examination of different populations of the species of which the largest material is available, namely *P. affinis*. The accompanying chart, Fig. 37, gives a survey of the result. The marks indicate the localities from which material has been examined, the different marks indicate different numbers of specimens examined, the small single circles 15—24, the larger ones 25—39 and the double circles 40 and more specimens, and the subjoined figures the average values of the figures of vertebræ. The curves noted are the isotherms at a depth of 100 meters. The youngest postlarvæ which presumably in this connection also must be taken into consideration practically as the ones in which the number is still during determination — in any case several of the hindmost myomeres cannot yet be distinguished in them — must, as stated, be assumed to occur mostly at a depth of about 70 meters, but, as previously mentioned, the temperatures at a depth of 75 meters observed by the "Dana" in the south-easterly part of the area of distribution in the North Atlantic lie fairly near those indicated by SCHOTT's isotherms at a depth of 100 meters, just as the values from the neighbouring stations to the only one, St. 1161, in that part of the area from which fairly large material is at hand, also show, *viz.* 16°.8 and 19°.8 respectively. The temperature at the rest of the stations at a depth of 75 meters is not very divergent from that at a depth of 100 meters and the relation between the different localities is about the same at the two depths.

As will be seen, the populations of the different localities present very different averages of the figures of vertebræ, from 78.35 to 81.60. The amount of the difference, 3.25, thus lies between the greatest and the least of the above mentioned differences between the respective forms of the three species, but between these values many intermediate ones have been found, several of which lie about midway between the extremes and which, certainly, supplemented with representative values in populations of a sufficiently large number of localities, would have formed quite a smooth transition from the one to the other.

It is a matter of course that the slightest differences between these averages, based as they are on

a fairly small number of specimens, cannot sustain the closer test achieved by a calculation of the probable fluctuation of the average values. Such a test, therefore, has been applied only as regards the extreme and two of the intermediate values which represent the greatest numbers of examined specimens, with the following result:—

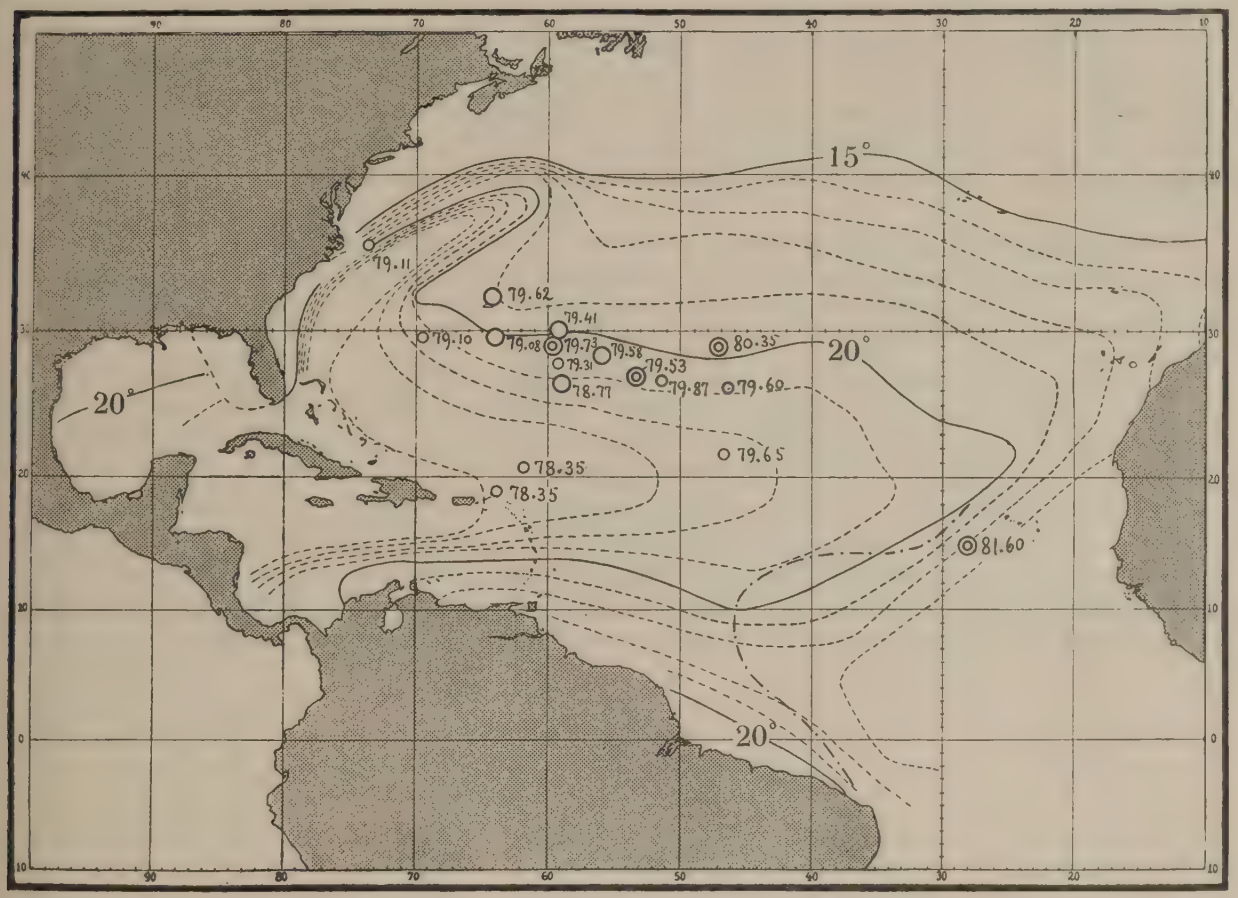

Fig. 37. *Paralepis affinis*, sp. n. Average values of figures of vertebræ in specimens taken in different localities. ○ indicates average values of figures of vertebræ in 15 to 24 specimens, ◯ the same in 25 to 39 and ◎ in 40 and more specimens. The isotherms at a depth of 100 meters are indicated (conf. the chart Fig. 34).

Station No.	1161	1362	1322	849 + 850
Position	14°52′ N., 28°04′ W.	28°57′ N., 47°24′ W.	27°02′ N., 53°39′ W.	19°00′ N., 63°53′ W. + 20°39′ N., 61°48′ W.
No. of vert.				
83	3	1	..	
82	21	7	1	
81	13	15	15	..
80	3	21	26	2
79	..	9	27	13
78	..	2	13	18
77	..	..	1	4
n	40	55	83	37
A	**81.600**	**80.345**	**79.530**	**78.351**
σ[1]	± 0.750	± 1.077	± 1.042	± 0.756
P. F. A.	± 0.400	± 0.490	± 0.385	± 0.420
	(81.20—82.00)	(79.86—80.84)	(79.14—79.92)	(77.93—78.77)

[1] Formulæ employed: $\sigma = \pm\sqrt{\frac{\Sigma ap^2}{n-1} - b^2}$; P. E. A. $= \pm\frac{\sigma}{\sqrt{n}} \times 0.6745$; P. F. A. $= 5 \times$ P. E. A.

The figures in brackets indicate the limits within which the true average value, with a probability of 1300—1400 to 1, will lie, and confirm the significance of the differences between the ascertained average values as only the fluctuations of the two intermediate values overlap each other and even only very slightly.

Then, if the proportions between the sizes of the average values in the populations of the different localities are compared with the course of the noted isotherms, one will find — at any rate in its broad features — a pronounced correlation between the temperature and the number of vertebræ manifesting itself as alterations in opposite directions of the sizes of the respective values. The small number of observations of the temperature at a depth of 75 meters, available from the stations concerned, shows the same relation.

These facts thus undoubtedly indicate a certain connection between the values of this character and the temperature. That one or more other factors might also make their influence felt, is possible, but not probable; at any rate the effect of such an influence must be minor, as the agreement in relation to the temperature appears to be general.

The ascertained gradation, with respect to the average number of vertebræ, running parallel with the gradation, with respect to the environment, places the differences found within this species in an absolute contrast to the same in the three other species discussed and confirms the correctness of the opinion advanced in the foregoing as to the forms of these species.

This distinction must be interpreted as an indication of different stages of evolution in the species under discussion, as *P. affinis* must be considered, as regards the character in question, a species which is still at a stage of differentiation, if the differences found in this species are, after all, of a genotypical nature, or, if the differences found are of a merely phænotypical nature, a species not differentiated at all — while the other three species must be regarded as specialized in a higher degree.

APPENDIX

LIST OF STATIONS WHERE *PARALEPIS* SPECIMENS WERE TAKEN

r of the hauls of *Paralepis* specimens made by the "Thor" in the Mediterranean (and Cadiz Bay), 1908--10.

te	Hour	Position		Depth Meters	Temperature							Gear	Wire out Meters	Duration of haul in minutes	P. rissoi rissoi				P. coregon. coregonoides				P. speciosus				P. sphyrænoides				P. pseudosphyrænoides thori			
															Sizes (mm)				Sizes (mm)				Sizes (mm)				Sizes (mm)				Sizes (mm)			
		Lat.	Long.		Surface	10 m.	25 m.	50 m.	100 m.	150 m.	200 m.				< 10	10—15	15—25	> 25	< 10	10—15	15—25	> 25	< 10	10—15	15—25	> 25	< 10	10—15	15—25	> 25	< 10	10—15	15—25	> 25
		N.	E.																															
08	5[00] a.m.	37°21′	16°45′	>2100	..	..	..	..	..	..	..	Y 200	25	60	.	.	.	.	2	4	3	.	.	.	.	.	.	.	1	.	.	.	.	.
»	6[10] a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	65	60	.	.	.	.	.	5	4	.	.	.	.	.	.	.	.	.	.	.	.	.
»	3[45] p.m.	..	..	..	..	..	..	..	..	..	..	Y 200	600	60	.	1	.	1	.	2	1	.	.	.	.	.	.	1	.	.	.	.	.	.
»	9[30] a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	1200	60	.	.	.	2	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.
08	4[00] a.m.	36°57′	18°16′	>3700	16°60	16°62	16°62	16°62	15°42	14°45	14°66	Y 200	25	60	.	.	.	.	31	20	.	.	.	.	.	.	1	.	4	.	.	.	.	.
»	5[25] a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	65	60	.	.	.	.	6	14	12	.	.	.	.	.	.	.	.	.	.	.	.	.
08	1[00] p.m.	39°34′	17°17′	1060	..	..	..	..	..	..	..	Y 200	65	30	.	.	.	.	.	4	5	.	.	.	.	.	.	.	.	.	.	.	.	.
»	11[40] a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	300	60	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.
08	8[50] p.m.	39°43′	17°30′	>1200	..	..	..	..	..	..	..	Y 200	65	60	.	2	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.
»	5[35] p.m.	..	..	..	..	..	..	..	..	..	..	Y 200	300	60	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
»	7[05] p.m.	..	..	..	..	..	..	..	..	..	..	Y 200	1000	60	.	4	1	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.
08	5[00] a.m.	41°24′	17°45′	1125	..	..	..	..	..	..	..	Y 200	65	60	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
08	2[40] a.m.	40°04′	19°06′	1000	15°20	15°43	15°41	15°21	14°66	14°25	14°19	Y 200	25	60	.	1	.	.	.	3	4	.	.	.	.	.	.	.	.	.	.	.	.	.
»	1[30] a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	65	60	.	.	1	.	.	7	6	.	.	.	.	.	.	.	.	.	.	.	.	.
»	5[20] a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	1400	60	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.
09	11[50] p.m.	37°51′	15°21′	>500	..	..	..	..	..	..	..	Y 200	10	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	2	.	.	.	.
09	8[00] p.m.	38°50′	15°18′	>750	..	..	..	..	..	..	..	Y 200	25	30	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.
»	8[45] p.m.	..	..	..	..	..	..	..	..	..	..	Y 200	200	30	.	.	.	.	.	2	.	.	.	.	.	.	.	.	3	.	.	.	.	.
09	11[50] p.m.	40°34′	13°24′	>1800	..	..	..	..	..	..	..	Y 200	25	30	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.
09	10[00] p.m.	40°14′	12°23′	>3700	14°15	14°20	14°10	14°02	13°77	13°62	13°85	Y 200	25	30	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.
09	4[30] a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	65	120	.	.	.	.	1	4	3	.	.	.	.	.	.	.	.	.	.	.	.	.
09	5[40] p.m.	40°34′	13°24′	>1800	..	..	..	..	..	..	..	Y 200	300	60	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
09	4[30] a.m.	40°40′	13°59′	560	..	..	..	..	..	..	..	Y 200	25	120	.	1	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.
09	0[45] a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	65	60	.	.	2	.	.	2	1	.	.	.	.	.	1	1	.	.	.	.	.	.
09	0[50] a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	150	180	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.
09	2[15] a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	300	60	.	4	2	.	.	.	1	.	.	.	.	.	.	.	1	.	.	.	.	.
09	2[30] a.m.	40°58′	13°49′	90	..	..	..	..	..	..	..	Y 200	25	180	.	1	.	.	.	1	.	.	.	.	.	.	.	.	.	1	.	.	.	.
09	7[30] p.m.	40°53′	13°43′	600	..	..	..	..	..	..	..	Y 200	25	60	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.
»	11[50] p.m.	..	..	..	..	..	..	..	..	..	..	Y 200	65	120	1	3	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.
»	10[00] p.m.	..	..	..	..	..	..	..	..	..	..	Y 200	100	60	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	2	.	.	.	.
»	9[00] p.m.	..	..	..	..	..	..	..	..	..	..	Y 200	200	30	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
»	6[40] p.m.	..	..	..	..	..	..	..	..	..	..	Y 200	400	30	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
»	5[00] p.m.	..	..	..	..	..	..	..	..	..	..	Y 200	1000	60	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.
09	8[40] p.m.	40°47′	12°55′	1550	..	..	..	..	..	..	..	Y 200	65	30	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
»	7[30] p.m.	..	..	..	..	..	..	..	..	..	..	Y 200	200	60	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.
»	9[30] p.m.	..	..	..	..	..	..	..	..	..	..	Y 200	600	60	.	.	1	1	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.
09	5[30] a.m.	41°15′	11°55′	>1800	13°60	13°68	13°69	13°71	13°62	13°81	13°82	Y 200	65	60	.	3	.	.	.	4	2	.	.	.	.	.	.	.	.	.	.	.	.	.
09	4[30] a.m.	41°44′	10°52′	1420	13°00	13°07	13°08	13°09	13°62	13°81	13°85	Y 200	65	30	.	2	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.
»	3[50] a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	200	30	1	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
»	3[00] a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	600	30	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.
»	1[20] a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	1400	60	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
09	6[30] p.m.	43°04′	9°35′	150	13°00	13°00	13°07	13°15	13°33	..	..	Y 200	65	30	.	.	1	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.
09	4[35] a.m.	43°27′	8°16′	>2000	..	..	..	..	..	..	..	Y 200	25	30	1	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
»	5[30] a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	65	30	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
»	6[35] a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	200	30	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
09	6[40] a.m.	43°36′	7°36′	>2000	12°80	12°89	12°90	12°94	12°96	..	12°93	Y 200	200	60	2	3	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
09	9[40] p.m.	..	..	..	..	..	..	..	..	..	..	Y 200	300	120	.	1	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
09	6[50] a.m.	42°49′	6°54′	>2000	..	..	..	..	..	..	..	Y 200	300	60	.	.	2	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
09	7[10] p.m.	40°45′	9°50′	105	12°80	12°81	12°81	12°82	12°83	..	..	Y 200	25	30	.	.	.	.	.	.	1	.	.	.	.	.	2	.	.	.	.	.	.	.
..	6[30] p.m.	..	..	..	..	..	..	..	..	..	..	Y 200	65	30	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Station No.	Date	Hour	Position		Depth Meters	Temperature							Gear	Wire out Meters	Duration of haul in minutes	P. rissoi rissoi Sizes (mm)				P. coregon. coregonoides Sizes (mm)				P. speciosus Sizes (mm)				P. sphyraenoides Sizes(mm)			
			Lat.	Long.		Surface	10 m.	25 m.	50 m.	100 m.	150 m.	200 m.				< 10	10—15	15—25	> 25	< 10	10—15	15—25	> 25	< 10	10—15	15—25	> 25	< 10	10—15	15—25	> 25
			N.	E.																											
39	1/2 09	5[00] a.m.	39°41′	10°02′	1750	13°20	13°26	13°26	13°27	13°75	13°81	13°92	Y 200	25	60	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.
»	»	6[10] a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	65	60	.	.	.	.	.	.	3	.	.	.	.	.	.	.	1	2
»	»	7[20] a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	300	60	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
12	2/2 09	9[40] p.m.	38°58′	9°37′	1120	13°30	13°39	13°39	13°40	13°80	13°81	13°84	Y 200	300	30	.	.	7	.	.	.	.	.	.	.	.	.	.	.	.	.
13	3/2 09	6[15] a.m.	38°14′	8°42′	>2000	13°80	13°97	13°97	13°98	13°68	13°44	13°96	Y 200	65	30	.	.	.	.	3	1	.	.	.	.	.	.	.	1	4	.
15	6/2 09	11[25] p.m.	37°28′	8°18′	>2150	14°00	11 14	14°12	14°12	14°44	14°45	13°53	Y 200	300	30	.	1	6	.	.	.	21	.	.	.	.	.	.	.	.	6
46	7/2 09	8[20] p.m.	37 17′	6°00′	>1930	14°20	14°29	14°30	14°40	14°24	14°03	13°15	Y 200	65	30	.	.	.	.	1	.	.	.	.	.	.	.	4	22	16	3
»	»	7[30] p.m.	..	..	..	..	..	..	..	..	..	..	Y 200	300	30	.	.	4	.	.	.	3	.	.	.	.	.	.	.	1	.
»	»	6[35] p.m.	..	..	..	..	..	..	..	..	..	..	Y 200	600	30	.	.	.	.	.	.	1	.	.	.	.	.	.	.	4	.
47	10/2 09	11[05] p.m.	36°55′	3°12′	>2000	14°50	14°53	14°51	14°50	14°61	14°10	13°95	Y 200	300	30	.	.	.	.	.	.	.	.	.	.	.	.	.	2	2	.
50	17/2 09	4[10] a.m.	37°02′	1°17′	>2000	13°40	13°46	13°46	14°03	13°20	12°97	12°94	Y 200	600	30	.	1	1	1	.	.	1	.	.	.	.	.	.	.	.	.
»	»	5[30] a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	1600	60	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
				W.																											
55	19/2 09	6[30] a.m.	36°46′	2°18′	75	..	..	..	..	..	..	..	Y 200	25	60	.	.	.	.	.	.	.	.	.	.	.	.	.	1	3	3
»	»	7[40] a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	65	60	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.
57	20/2 09	5[45] a.m.	36°40′	3°30′	105	..	..	..	..	..	..	..	Y 200	25	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4
»	»	6[35] a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	200	30	.	.	1	.	.	.	1	.	.	.	.	.	.	.	7	.
58	20/2 09	3[00] p.m.	36°36′	4°24′	85	13°65	13°99	14°11	13°94	..	..	..	Y 200	65	30	.	.	.	.	.	.	.	.	.	.	.	.	1	2	.	.
»	»	2[00] p.m.	..	..	..	..	..	..	..	..	..	..	Y 200	100	30	.	7	1	.	.	.	.	.	.	.	.	.	.	2	2	.
59	21/2 09	1[00] a.m.	36°02′	4°24′	1260	14°50	14°51	14°27	14°04	13°70	13°03	12°91	Y 200	100	30	.	.	.	.	.	.	.	.	.	.	.	.	.	1	3	1
»	»	1[40] a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	500	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
66	25/2 09	5[15] a.m.	36°16′	6°52′	735	14°80	14°90	14°90	14°91	14°91	14°87	14°62	Y 200	600	120	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.
89	18/6 10	3[00] a.m.	36°28′	8°22′	1310	18°98	..	18°60	16°61	15°09	..	13°51	Y 200	65	15	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.
99	23/6 10	11[25] p.m.	36°02′	5°16′	750	16°80	..	16°48	15°00	14°77	13°15	12°97	Y 200	300	30	.	.	.	.	.	.	.	.	.	.	.	.	.	5	1	.
106	25/6 10	1[45] a.m.	36°33′	2°00′	c. 1100	20°92	..	16°09	14°86	13°61	13°03	12°89	Y 200	300	30	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	6
108	25/6 10	11[55] p.m.	36°03′	0°27′	> 2400	21°00	18°91	17°19	15°38	13°76	13°01	12°95	Y 200	25	15	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
»	»	11[15] p.m.	..	..	..	..	..	..	..	..	..	..	Y 200	65	30	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
»	»	10[30] p.m.	..	..	..	..	..	..	..	..	..	..	Y 200	300	30	.	.	.	.	.	2	.	.	.	.	.	.	.	3	1	.
»	26/6 10	0[40] a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	2000	60	.	1	.	.	.	.	.	.	.	.	.	.	.	1	.	.
				E.																											
112	27/6 10	1[30] a.m.	36°56′	2°15′	2700	21°96	19°66	16°17	13°65	13°08	12°93	12°96	Y 200	25	15	.	.	.	.	.	.	.	.	.	.	.	.	.	1	3	.
»	»	1[05] a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	65	15	.	.	.	.	.	.	.	.	.	.	.	.	.	1	7	3
»	»	0[15] a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	300	30	.	5	3	.	.	.	.	.	.	.	.	.	.	.	.	1
113	28/6 10	3[25] a.m.	36°53′	3°09′	815	20°96	..	16°39	16°04	14°19	13°13	13°12	Y 200	300	30	.	4	2	.	.	.	1	.	.	.	.	.	.	2	.	.
115	29/6 10	1[20] a.m.	38°17′	4°11′	2800	21°92	21°11	17°97	14°72	13°23	13°14	13°21	Y 200	65	15	.	.	.	.	.	.	.	.	.	.	.	.	.	1	6	.
»	28/6 10	11[20] p.m.	..	..	..	..	..	..	..	..	..	..	Y 200	300	30	.	1	1	.	.	.	2	.	.	.	.	.	.	.	.	.
»	29/6 10	0[30] a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	2000	60	.	1	2	.	.	.	.	.	.	.	.	2	.	1	2	.
116	30/6 10	2[30] a.m.	39°27′	5°26′	2860	21°90	20°38	18°48	15°22	13°30	..	13°16	Y 200	65	30	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
»	»	1[40] a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	300	30	1	2	4	.	1	.	.	.	.	.	.	.	.	.	.	.
118	1/7 10	0[20] a.m.	41°00′	6°43′	> 2700	20°73	20°56	17°48	14°66	13°42	13°20	13°57	Y 200	25	15	.	.	.	.	.	.	.	.	.	.	.	.	.	1	3	.
»	30/6 10	11[35] p.m.	..	..	..	..	..	..	..	..	..	..	Y 200	65	30	.	.	.	.	.	9	1	.	.	.	.	.	.	.	.	.
»	»	10[55] p.m.	..	..	..	..	..	..	..	..	..	..	Y 200	300	30	.	2	2	.	.	1	1	.	.	.	.	.	.	.	.	.
120	1/7 10	8[50] p.m.	42°31′	7°41′	c. 2700	18°36	..	15°02	13°42	13°10	13°17	13°12	Y 200	300	30	.	.	3	1	.	.	.	.	.	.	.	.	.	.	.	.
122	2/7 10	10[00] a.m.	43°50′	8°34′	1285	19°46	17°77	13°58	13°22	13°20	13°35	13°54	Y 200	600	60	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.
123	3/7 10	0[05] a.m.	44°14′	8°55′	c. 700	20°26	..	16°72	14°20	13°50	13°38	13°32	Y 200	300	30	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.
125	9/7 10	10[30] p.m.	43°54′	9°13′	1082	19°06	17°96	14°60	13°42	13°26	13°32	13°46	Y 200	25	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
126	10/7 10	9[30] p.m.	42°43′	9°50′	588	21°66	20°62	19°50	15°23	13°93	13°54	13°46	Y 200	300	30	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.
129	12/7 10	3[40] a.m.	40°05′	11°31′	3420	21°76	21°16	19°68	15°18	13°75	13°86	13°97	Y 200	300	30	.	.	3	.	1	3	9	.	.	.	.	.	.	.	.	.
»	»	8[00] p.m.	..	..	..	..	..	..	..	..	..	..	Y 200	600	30	.	.	.	1	.	2	2	.	.	.	.	.	.	.	.	.
»	»	4[20] a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	1000	60	.	.	.	.	.	1	.	.	.	.	.	.	.	1	.	.
»	»	3[00] p.m.	..	..	..	..	..	..	..	..	..	..	C 200	3500	120	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.
130	13/7 10	0[50] a.m.	39°35′	11°20′	> 3000	..	..	..	..	..	..	..	Y 200	25	30	.	.	.	.	.	.	.	.	.	.	.	.	2	4	1	.
131	13/7 10	10[40] a.m.	38°36′	11°00′	915	21°48	20°42	19°72	14°58	13°40	13°74	13°74	Y 200	1000	60	.	.	.	.	.	2	2	.	.	.	.	.	.	.	.	.

e	Hour	Position		Depth Meters	Temperature							Gear	Wire out Meters	Duration of haul in minutes	P. rissoi rissoi				P. coregon. coregonoides				P. speciosus				P. sphyrænoides				P. pseudosphyrænoides thori			
															Sizes (mm)				Sizes (mm)				Sizes (mm)				Sizes (mm)				Sizes (mm)			
		Lat.	Long.		Surface	10 m.	25 m.	50 m.	100 m.	150 m.	200 m.				< 10	10—15	15—25	> 25	< 10	10—15	15—25	> 25	< 10	10—15	15—25	> 25	< 10	10—15	15—25	> 25	< 10	10—15	15—25	> 25
		N.	E.																															
10	3^{45} a.m.	38°57′	9°47′	1227	20°46	19°00	15°25	14°16	13°50	13°51	13°61	Y 200	300	30	.	.	2	.	.	7	11	.	.	.	.	.	.	1	.	.	.	.	.	.
	3^{05} a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	25	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	5	.	.
	4^{50} a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	600	30	.	.	2	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
10	11^{00} p.m.	38°18′	9°59′	602	21°82	20°72	19°66	14°48	13°52	13°68	13°82	Y 200	25	30	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	6	5	.	.
	10^{15} p.m.	..	..	..	..	..	..	..	..	..	..	Y 200	300	30	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
10	4^{50} a.m.	37°37′	10°17′	350	22°60	21°67	20°40	15°41	13°92	13°50	13°68	Y 200	25	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	9	1	.
	5^{10} a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	300	30	.	2	.	.	.	1	3	.	.	.	.	.	.	.	.	.	.	1	.	.
10	8^{15} a.m.	37°17′	10°56′	190	22°76	22°00	19°90	15°48	14°06	13°69	..	Y 200	25	30	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	9^{05} a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	250	30	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.
10	9^{50} p.m.	37°37′	11°25′	820	23°50	22°43	19°98	..	14°43	13°79	13°81	Y 200	25	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.
	9^{10} p.m.	..	..	..	..	..	..	..	..	..	..	Y 200	300	60	.	.	.	.	.	2	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	7^{40} p.m.	..	..	..	..	..	..	..	..	..	..	Y 200	1000	60	.	.	.	.	.	.	1	.	.	.	.	.	1	.	.	.	.	.	.	.	.
10	1^{20} a.m.	35°18′	16°25′	1842	25°26	23°08	17°28	16°17	14°69	14°36	14°20	Y 200	25	30	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	45	1
	0^{30} a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	300	30	4	36	18	.	.	6	2	.	.	.	.	.	.	1	.	.	.	.	.	.	1
	2^{00} a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	1000	60	.	.	.	.	.	1	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
10	2^{00} a.m.	34°31′	18°40′	3340	26°05	25°30	22°50	17°28	15°40	14°66	14°41	Y 200	25	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	5	.	.
	2^{45} a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	300	30	.	.	1	.	.	15	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	3^{45} a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	2000	60	1	2	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	1	.
10	3^{30} a.m.	32°38′	19°02′	3340	25°36	25°36	23°40	17°76	15°38	14°87	14°49	Y 200	25	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7	2	.
	4^{10} a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	300	30	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.
10	11^{35} p.m.	31°35′	19°02′	960	25°20	25°12	23°69	17°42	15°70	15°12	11°64	Y 200	25	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	1	.
10	0^{20} a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	300	30	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
10	11^{35} p.m.	33°11′	21°44′	> 2200	24°34	24°35	24°30	19°20	15°99	15°11	14°99	Y 200	300	30	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
10	0^{30} a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	1000	60	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
10	2^{15} a.m.	32°16′	26°03′	c. 3200	25°47	25°46	22°60	17°25	15°70	15°31	15°11	Y 200	25	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	6	18	1
»	3^{50} a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	300	30	.	.	1	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	1	.
»	3^{00} a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	600	30	.	.	.	.	.	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.
»	0^{40} a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	1000	60	.	.	2	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	2	.	.
10	2^{00} a.m.	35°59′	28°14′	> 1000	26°28	26°05	21°70	17°25	15°02	14°57	14°36	Y 200	25	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	1	1	.
»	2^{45} a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	300	30	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.
»	3^{35} a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	1000	60	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	1	.	.
10	3^{00} a.m.	36°12′	27°16′	> 1000	..	..	..	..	..	..	..	Y 200	25	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	18	10	3
10	1^{05} a.m.	37°52′	26°22′	1170	22°60	22°45	18°75	17°36	16°28	15°88	15°26	Y 200	200	15	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.
»	0^{05} a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	1000	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.
10	2^{15} a.m.	40°02′	25°55′	85	..	..	..	..	..	..	..	Y 200	65	30	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.
10	2^{55} p.m.	38°49′	25°09′	255	24°55	24°2	17°85	15°54	14°83	14°59	..	Y 200	65	15	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.
10	11^{00} p.m.	38°13′	24°48′	500	25°5	25°5	22°05	16°25	14°72	..	14°32	Y 200	10	15	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.
»	10^{30} p.m.	..	..	..	..	..	..	..	..	..	..	Y 200	65	15	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	1	.	.	.	.
	11^{40} p.m.	..	..	..	..	..	..	..	..	..	..	Y 200	600	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.
10	11^{30} p.m.	37°57′	19°51′	> 3000	24°0	23°95	18°3	15°5	13°79	14°02	14°01	Y 200	10	15	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	4	.
	8^{15} p.m.	..	..	..	..	..	..	..	..	..	..	Y 200	300	15	.	4	5	.	.	1	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.
10	0^{45} a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	1200	30	1	1	.	.	.	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.
10	7^{45} p.m.	37°54′	18°02′	> 2500	25°05	..	24°0	17°4	15°10	14°47	..	Y 200	25	15	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	13	.	.
	0^{55} p.m.	..	..	..	..	..	..	..	..	..	..	Y 200	300	15	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	6^{40} p.m.	..	..	..	..	..	..	..	..	..	..	Y 200	1000	30	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
10	8^{55} a.m.	37°44′	15°58′	< 2000	25°9	24°8	18°6	16°2	14°65	14°18	14°23	Y 200	300	15	.	.	.	.	.	2	4	.	.	.	.	.	.	.	.	.	.	.	.	.
	9^{30} a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	1000	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.
10	10^{50} p.m.	38°07′	15°35′	652	23°5	21°75	18°80	16°97	14°29	13°82	13°75	Y 200	600	30	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
10	0^{50} a.m.	38°15′	15°39′	> 100	..	..	..	..	..	..	..	Y 200	10	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.
10	1^{30} a.m.	38°33′	15°29′	1140	25°4	25°2	21°5	16°18	14°52	13°71	13°71	Y 200	10	15	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.
	5^{00} a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	25	15	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	1
	6^{00} a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	1200	30	.	.	.	1	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Station No.	Date	Hour	Position		Depth Meters	Temperature							Gear	Wire out Meters	Duration of haul in minutes	P. rissoi rissoi				P. coregon. coregonoides				P. speciosus				P. sphyræ noides			
																Sizes (mm)				Sizes (mm)				Sizes (mm)				Sizes (mm)			
			Lat.	Long.		Surface	10 m.	25 m.	50 m.	100 m.	150 m.	200 m.				< 10	10—15	15—25	> 25	< 10	10—15	15—25	> 25	< 10	10—15	15—25	> 25	< 10	10—15	15—25	> 25
			N.	E.																										
196	22/8 10	2⁴⁰ a.m.	39°59′	14°31′	> 600	..	..	..	..	..	..	..	Y 200	25	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
197	24/8 10	7⁴⁵ p.m.	40°34′	13°36′	> 1000	23°9	24°0	19°9	15°6	14°0	13°82	13°93	Y 200	25	15	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.
»	»	7⁶⁰ p.m.	..	..	..	..	..	..	..	..	..	..	Y 200	300	30	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.
199	25/8 10	9⁰⁰ p.m.	39°32′	10°49′	c. 2700	24°9	24°6	21°2	15°81	13°72	13°54	13°63	Y 200	25	15	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
»	»	9²⁵ p.m.	..	..	..	..	..	..	..	..	..	..	Y 200	300	20	5	4	8	1	.	2	2	.	.	.	.	.	.	.	.	.
»	»	10¹⁰ p.m.	..	..	..	..	..	..	..	..	..	..	Y 200	1000	30	.	1	1	.	.	.	1	.	.	.	.	.	.	.	.	.
200	26/8 10	3⁴⁵ a.m.	39°18′	10°11′	> 2000	..	..	..	..	..	..	..	Y 200	25	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
202	26/8 10	5⁰⁵ p.m.	38°59′	9°25′	760	24°5	23°75	17°95	14°35	13°80	13°43	13°62	Y 200	300	15	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.
204	27/8 10	4⁰⁰ a.m.	38°52′	7°43′	> 1000	23°50	23°52	18°5	14°7	13°26	13°22	13°43	Y 200	25	15	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
»	»	4³⁰ a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	65	15	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
206	28/8 10	0³⁰ a.m.	39°32′	5°15′	c. 2860	24°9	24°95	24°6	17°6	13°43	13°02	12°91	Y 200	25	15	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
»	»	1⁰⁵ a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	300	15	.	8	.	.	.	1	5	.	.	.	.	.	.	.	.	.
»	»	1⁴⁰ a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	1000	45	.	.	.	1	.	.	2	.	.	.	.	.	.	.	.	.
»	»	3⁰⁵ a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	2000	45	.	2	2	2	.	.	.	.	.	.	3	3	.	.	.	.
208	29/8 10	1⁴⁰ a.m.	40°18′	3°20′	> 1600	..	..	..	..	..	..	..	Y 200	25	15	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
209	29/8 10	4⁵⁵ a.m.	40°34′	3°03′	> 2000	24°5	24°3	23°85	15°75	13°22	12°90	12°74	Y 200	25	15	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
»	»	5²⁵ a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	300	15	.	.	.	1	.	.	.	.	.	.	6	4	.	.	.	.
»	»	6⁰⁰ a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	1000	45	.	3	1	.	.	.	.	.	.	.	.	.	.	.	.	.
»	»	7²⁵ a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	2000	45	.	5	4	.	.	.	.	.	.	.	1	.	.	.	.	.
210	30/8 10	3³⁵ a.m.	41°10′	2°23′	780	24°00	..	22°45	19°5	13°70	13°23	13°23	Y 200	600	30	.	1	8	1	.	.	.	.	.	.	.	.	.	.	.	.
211	30/8 10	5²⁰ a.m.	41°17′	2°13′	150	..	..	..	..	..	..	..	Y 200	25	60	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
215	31/8 10	9²⁰ p.m.	39°14′	0°52′	> 1050	25°02	..	18°75	15°45	13°06	13°12	13°01	Y 200	25	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
217	1/9 10	1⁴⁰ p.m.	38°01′	1°48′	> 2000	24°8	24°4	17°3	14°38	13°26	12°85	12°90	Y 200	300	15	.	3	2	.	.	.	3	.	.	.	.	.	.	.	.	1
218	2/9 10	2⁰⁰ a.m.	36°54′	2°57′	c. 2000	23°50	23°45	17°10	15°17	14°30	13°07	12°95	Y 200	25	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	11	2
»	»	2⁴⁵ a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	300	30	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.
220	4/9 10	2¹⁵ a.m.	36°25′	0°42′	> 350	..	..	..	..	..	..	..	Y 200	25	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	2
				W.																										
221	4/9 10	6³⁵ p.m.	35°44′	0°53′	30	..	..	..	..	..	..	..	Y 200	25	15	.	.	.	.	.	.	.	.	.	.	.	.	1	2	.	.
222	4/9 10	11²⁰ p.m.	35°53′	0°57′	c. 2000	22°88	22°85	17°1	15°12	13°82	13°05	12°85	Y 200	300	30	.	.	2	.	.	.	1	.	.	.	.	.	.	.	.	.
223	5/9 10	4⁵⁸ a.m.	36°13′	1°28′	> 2000	22°9	22°9	20°20	16°78	15°01	14°09	13°17	Y 200	300	30	.	.	2	.	.	.	.	.	.	.	.	.	.	.	1	.
»	»	4³⁵ a.m.	..	..	..	..	..	..	..	..	..	..	Y 200	25	15	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	4
224	5/9 10	7⁵⁰ p.m.	36°33′	2°00′	> 950	23°7	23°45	21°75	16°65	15°15	14°62	13°87	Y 200	25	15	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7
»	»	7²⁰ p.m.	..	..	..	..	..	..	..	..	..	..	Y 200	300	15	.	2	3	.	.	.	.	.	.	.	.	.	1	2	2	.
225	6/9 10	3³⁰ a.m.	36°35′	3°00′	200	..	..	..	..	..	..	..	Y 200	25	15	.	.	.	.	.	.	.	.	.	.	.	.	.	2	2	.
228	7/9 10	1⁵⁵ a.m.	36°02′	5°06′	> 800	18°42	..	17°10	15°02	13°70	13°16	12°95	Y 200	300	30	.	.	1	.	.	.	.	.	.	.	.	.	.	3	.	.
229	8/9 10	5⁴⁰ a.m.	35°51′	5°58′	343	21°45	21°30	19°38	15°18	13°82	13°23	12°71	Y 200	300	30	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.
231	9/9 10	0¹⁵ a.m.	35°56′	7°16′	> 950	21°30	21°30	19°04	16°24	14°86	14°20	13°45	Y 200	25	30	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.
232	9/9 10	9³⁵ p.m.	36°28′	9°06′	c. 3500	22°5	..	22°5	16°94	14°55	..	13°23	Y 200	300	30	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.
»	»	10³⁵ p.m.	..	..	..	..	..	..	..	..	..	..	Y 200	1000	30	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.
»	»	11⁴⁵ p.m.	..	..	..	..	..	..	..	..	..	..	Y 200	2000	30	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.

Record of the hauls of *Paralepis* specimens made in the Mediterranean by Capt. G. Hansen, 1911 and by the S/S "Pangan", 1911 and 1912.

Station No.	Date	Hour	Position Lat.	Position Long.	Temperature Surface	Wire out Meters	Duration af haul in minutes	P. rissoi rissoi Sizes (mm) < 10	10—15	15—25	> 25	P. coregonoides coregonoides Sizes (mm) < 10	10—15	15—25	> 25	P. sphyræ-noides Sizes (mm) < 10	10—15	15—25	> 25	P. pseudosphyr. thori Sizes (mm) < 10	10—15	15—25	> 25
			N.	E.																			
283	12/8 11	6³⁰ p.m.	38°12′	15°37′	13°7	40	180	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
»	»	9⁴⁵ p.m.	38°12′	15°37.5′	13°7	40	180	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.
284	14/8 11	6⁰⁰ p.m.	..	..	13°6	40	180	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.
»	»	9¹⁵ p.m.	..	..	13°5	40	180	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
»	15/8 11	1⁰⁰ a.m.	38°10.5′	15°34.5′	13°3	40	90	2	.	1	.	.	1	.	.	.	1	.	.	.	.	.	.
285	16/8 11	9⁰⁰ p.m.	38°15.5′	15°39.5′	13°6	40	150	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.
»	17/8 11	0¹⁰ a.m.	38°15.5′ 38°11.5′	15°39.5 15°35.5′	13°6	30	180	.	.	.	.	.	2	1	.	1	.	1	.	.	.	.	.
286	18/8 11	6³⁰ p.m.	38°12′	15°35.5′	13°8	40	180	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.
»	»	10⁰⁰ p.m.	38°12.5′	15°34.5′	13°6	40	180	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.
»	19/8 11	2³⁰ a.m.	38°10.5′	15°34.5′	13°6	30	90	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.
287	24/8 11	7⁴⁵ p.m.	38°12′	15°34.5′	13°8	40	90	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.
»	»	11⁴⁵ p.m.	38°10.5′	15°34.5′	13°7	40	90	.	.	.	.	.	.	.	.	1	1	1	.	.	.	.	.
289	4/4 11	9¹⁰ p.m.	38°15′	15°39.5′	14°0	25	90	.	.	.	.	.	.	1	.	1	1	1	.	.	.	.	.
297	25/6 11	11³⁰ p.m.	33°10′	25°03′	22°4	28	30	.	.	.	.	.	.	.	.	.	.	.	.	.	6	7	.
298	26/6 11	11³⁰ p.m.	34°20′	21°10′	22°5	38	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
384	7/11 11	8³⁰ p.m.	32°50′	27°10′	18°5	138	30	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.
				W.																			
410	29/12 11	7⁰⁰ p.m.	37°12′	1°18′	..	112	30	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.
				E.																			
412	7/1 12	6³⁰ p.m.	34°33′	24°15′	..	112	30	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
				W.																			
530	9/8 12	4⁰⁰ a.m.	36°40′	1°16′	..	57	30	.	.	.	.	.	.	.	.	.	.	.	.	.	1	2	.

Record of the hauls of *Paralepis rissoi rissoi* made by the "Dana", 1921—22.

Station No.	Date	Hour	Position Lat.	Position Long.	Temperature Surface	Temperature 150 m.	Temperature 200 m.	Gear	Wire out Meters	Duration of haul in minutes	Sizes (mm) < 10	10—15	15—25	25—40	> 40
			N.	W.											
1107	13/9 21	7³⁰ p.m.	36°28′	8°38′	19°87	..	13°41	S 200x	200	120	..	3	8	..	..
»	»	»	..	..	..	..	..	Y 200	300	120	1	2	7	2	..
1108	14/9 21	11³⁰ p.m.	35°11′	8°28′	21°41	..	13°88	Y 200	200	60	..	2	6	..	..
»	»	8¹⁵ p.m.	..	..	..	..	..	Y 200	300	120	8	29	10	..	..
1110	15/9 21	7²⁵ p.m.	34°18′	8°10′	22°76	..	14°14	Y 200	300	120	3	2	1	..	..
1113	17/9 21	11⁵⁰ p.m.	36°10′	6°42′	22°28	14°46	13°82	Y 200	300	120	..	2	..	..	..
				E.											
1122	26/9 21	0¹⁰ a.m.	37°12′	1°08′	23°8	..	..	S 200	300	120	1	..	1	..	..
1123	26/9 21	6⁴⁰ p.m.	37°48′	2°44′	24°50	13°05	13°01	S 200	300	120	3	8	4	..	..
1126	1/10 21	3¹⁰ a.m.	37°06′	2°25′	22°9	13°10	13°04	S 200	200	120	..	..	1	..	..
»	»	»	..	..	..	..	..	S 200x	250	120	..	1	2	..	..
»	»	»	..	..	..	..	..	S 200	300	120	..	..	1	..	..
1128	1/10 21	9⁵⁰ p.m.	36°46′	0°16′	22°60	..	..	S 200	400	60	..	3	1	..	..
»	»	»	..	..	..	..	..	S 200	500	60	2	24	9	..	..
				W.											
1129	2/10 21	3²⁰ a.m.	36°43′	0°23′	23°60	..	..	S 200	300	120	..	1	2	..	..
1131	2/10 21	11¹⁰ p.m.	36°11′	2°12′	22°10	..	..	S 200	400	60	..	..	2	..	..
1140	14/10 21	2³⁰ a.m.	32°45′	16°20′	21°60	..	..	S 200	400	120	1	1	..	..	..
1141	14/10 21	9⁰⁰ p.m.	34°15′	16°53′	21°4	..	..	S 200	500	120	..	..	1	..	..

Station No.	Date	Hour	Position Lat.	Position Long.	Temperature Surface	Temperature 100 m.	Temperature 200 m.	Gear	Wire out Meters	Duration of haul in minutes	Sizes (mm) <10	10—15	15—25	25—40	>40
			N.	W.											
1141	15/10 21	3^00 a.m.	34°15′	16°53′	..	..	..	S 200	500	180	1	1	1	..	..
»	14/10 21	11^55 p.m.	..	..	..	..	..	S 200	600	120	3	2	4	..	..
1145	19/10 21	1^15 a.m.	32°07′	16°50′	22°10	..	..	S 200	500	120	3	..	..	..	..
1147	20/10 21	4^00 a.m.	32°00′	20°01′	22°10	..	..	S 200	500	120	2	..	..	..	..
1148	20/10 21	8^15 p.m.	32°55′	21°51′	21°90	..	..	S 200	400	60	..	4	..	..	..
	»	»	..	..	..	..	..	S 200	500	60	1	5	..	..	..

Record of the hauls of *Paralepis rissoi kroyeri.*

Station No.	Date	Hour	Position Lat.	Position Long.	Temperature Surface	Temperature 100 m.	Temperature 200 m.	Gear	Wire out Meters	Duration of haul in minutes	Sizes (mm) <10	10—15	15—25	25—40	>40
			N.	W.											
81.05	14/6 05	7^35 a.m.	51°32′	12°03′	13°8	..	..	Y 330	300	120	..	..	1	..	..
82.05	15/6 05	8^20 a.m.	51°00′	11°43′	13°79	10°52	..	Y 330	600	120	..	1	3	..	..
»	»	3^45 p.m.	..	..	..	..	..	Y 330	800	120	..	..	..	1	..
88.05	20/6 05	8^45 p.m.	48°09′	8°30′	..	..	..	Y 200	300	120	..	..	1	..	..
93.05	24/6 05	10^30 p.m.	49°25′	12°20′	15°10	10°92	..	Y 330	300	120	..	..	..	..	2
36.06	10/5 06	2^55 a.m.	44°21′	2°37′	..	..	..	Y 330	300	120	..	..	..	2	..
38.06	11/5 06	3^00 a.m.	43°52′	2°27′	..	..	..	Y 330	250	120	..	..	1	..	..
46.06	17/5 06	4^35 a.m.	44°37′	2°17′	13°0	..	..	Y 330	400	120	..	..	2	..	..
50.06	19/5 06	2^20 a.m.	46°50′	5°22′	11°54	..	..	Y 330	300	120	..	..	2	1	..
51.06	20/5 06	3^00 a.m.	48°07′	9°03′	11°36	11°21	..	Y 330	300	120	2	3	2	1	..
52.06	21/5 06	0^25 a.m.	48°43′	12°05′	11°71	..	..	Y 330	300	120	..	14	72	17	..
»	»	6^10 a.m.	..	..	..	..	..	Y 330	300	120	..	..	3	2	..
53.06	21/5 06	0^05 p.m.	48°55′	12°03′	11°70	..	..	Y 330	300	120	..	7	22	1	..
54.06	21/5 06	4^55 p.m.	49°13′	11°58′	11°70	..	..	Y 330	300	120	..	..	5	4	..
55.06	21/5 06	9^55 p.m.	49°23′	12°12′	11°34	..	..	Y 330	300	120	..	..	6	2	..
61.06	31/5 06	7^45 a.m.	51°04′	11°39′	..	..	..	Y 330	300	120	..	1	3	1	..
»	»	10^20 a.m.	..	..	..	..	..	Y 330	400	120	..	..	11	3	..
»	»	1^05 p.m.	..	..	..	..	..	Y 330	500	120	..	..	6	3	..
»	»	6^50 p.m.	..	..	11°55	..	..	Y 330	800	120	..	..	2	1	..
62.06	5/6 06	0^15 a.m.	50°25′	12°44′	..	..	..	Y 330	200	120	..	..	3	..	..
»	4/6 06	9^55 p.m.	..	..	12°00	10°61	..	Y 330	300	120	..	..	..	2	..
65.06	6/6 06	7^00 a.m.	49°04′	14°52′	13°35	11°52	..	Y 330	300	120	..	1	21	1	..
66.06	6/6 06	2^15 p.m.	48°43′	15°17′	13°25	..	..	Y 330	300	60	..	..	..	4	..
»	»	3^30 p.m.	..	..	..	..	..	Y 330	400	60	..	2	9	..	..
71.06	8/6 06	3^15 p.m.	48°05′	11°50′	14°59	..	..	Y 330	300	60	..	..	1	..	..
73.06	9/6 06	4^50 a.m.	48°43′	12°05′	13°25	..	..	Aa. T	400	60	..	..	..	1	..
74.06	10/6 06	6^35 a.m.	49°23′	12°13′	14°78	10°85	..	Y 330	2000	60	..	..	..	1	1
76.06	12/6 06	5^05 a.m.	49°27′	13°33′	14°5	..	..	Y 330	300	120	..	..	..	1	..
78.06	15/6 06	9^00 p.m.	51°35′	11°36′	12°84	..	..	Y 330	200	60	..	..	..	2	..
80.06	16/6 06	6^30 p.m.	51°34	11°50′	13°04	..	..	Y 200	1200	120	..	..	..	1	1
167.06	26/8 06	10^30 a.m.	51°28′	11°50′	..	..	..	Y 330	200	120	..	1	..	..	..
»	»	8^00 a.m.	..	..	15°80	10°71	10°31	Y 200	300	120	..	..	..	2	..
»	»	1^05 p.m.	..	..	..	..	..	Y 330	350	60	..	..	..	1	..
168.06	28/8 06	10^30 p.m.	51°30′	11°37′	16°59	..	..	Y 330	300	60	..	..	5	7	..
173.06	30/8 06	5^40 a.m.	50°31′	11°37′	15°94	..	..	Y 330	300	120	..	..	3	..	..
174.06	30/8 06	0^05 p.m.	51°16′	11°31′	14°40	..	..	Y 330	300	60	..	..	..	1	..
175.06	30/8 06	2^45 p.m.	51°11′	11°41′	16°38	..	..	Y 330	300	60	..	..	1	..	..
176.06	31/8 06	9^30 p.m.	49°31′	11°51′	17°22	11°31	..	Y 330	300	120	..	..	7	5	..
177.06	1/9 06	1^30 a.m.	49°30′	11°38′	..	..	..	Y 330	300	120	..	..	1	2	..
»	»	8^10 a.m.	..	..	..	..	..	Y 330	600	60	..	..	..	1	..
178.06	2/9 06	3^15 a.m.	48°04′	12°40′	18°50	11°56	..	Y 330	300	120	..	8	3	..	..

Station No.	Date	Hour	Position		Temperature			Gear	Wire out Meters	Duration of haul in minutes	Sizes (mm)				
			Lat.	Long.	Surface	100 m.	200 m.				< 10	10—15	15—25	25—40	> 40
			N.	W.											
179.06	2/9 06	9³⁰ p.m.	47°20′	12°23′	19°38	..	..	Y 330	300	120	..	..	8	3	..
182.06	4/9 06	8⁰⁰ p.m.	50°11′	12°05′	17°62	..	..	Y 330	300	60	..	..	..	1	..
185.06	7/9 06	11⁰⁰ p.m.	51°56′	11°55′	16°14	..	..	Y 330	250	120	..	..	2	..	..
»	»	8³⁰ p.m.	..	..	..	..	..	Y 330	300	120	..	..	1	..	..
186.06	8/9 06	8²⁵ p.m.	50°06′	11°06′	17°22	..	..	Y 330	300	60	..	..	7	3	..
189.06	10/9 06	2⁰⁰ p.m.	47°22′	7°55′	19°30	..	..	Y 330	300	60	..	1	..	..	..
12.08	28/5 08	..	57°03′	11°20′	10°6	..	..	Y 200	1000	60	..	..	1	..	..
74.09	8/3 09	10⁵⁰ p.m.	44°21′	7°55′	11°50	11°55	11°54	Y 200	300	60	..	..	1	..	..
»	9/3 09	0¹⁰ a.m.	..	..	..	..	..	Y 200	600	60	..	..	..	1	..
75.09	9/3 09	10¹⁵ p.m.	45°37′	7°03′	11°40	11°27	11°29	Y 200	25	30	..	..	1	..	..
»	»	9⁰⁰ p.m.	..	..	..	..	..	Y 200	65	60	..	..	1	..	..
»	»	7⁴⁵ p.m.	..	..	..	..	..	Y 200	300	60	..	..	3	1	..
76.09	10/3 09	6⁰⁵ p.m.	47°01′	5°48′	10°78	10°81	10°78	Y 200	65	60	..	3	1	..	..
»	»	11³⁰ a.m.	..	..	..	..	..	Y 200	300	60	..	..	4	..	..
»	»	1¹⁵ p.m.	..	..	..	..	..	Y 200	600	60	..	..	1	..	..
»	»	2⁴⁰ p.m.	..	..	..	..	..	Y 200	1600	60	..	..	..	1	..
423	6/3 12	9⁰⁰ p.m.	46°59′	21°48′	11°0	..	..	S 150	66	30	..	1	..	..	..
450	7/3 12	1⁰⁵ a.m.	41°48′	18°52′	12°6	..	..	S 150	95	30	..	..	1	..	..
713	23/3 13	11⁰⁰ p.m.	38°44′	69°3′	8°4	..	..	S 150	141	30	..	1	1	..	..
1002	19/7 13	2⁰⁰ a.m.	57°27′	20°07′	12°0	..	..	PS 150	300	240	..	..	6	..	..
»	»	»	..	..	..	..	..	PS 150	1000	240	..	..	1	..	..
1023	18/9 13	0³⁰ a.m.	40°34′	48°53′	19°7	..	..	PS 150	300	240	..	..	..	1	..
1024	20/9 13	0¹⁵ a.m.	42°19′	50°22′	19°4	..	..	S 150	300	240	..	..	1	7	1
1103	9/9 21	7⁴⁵ p.m.	45°46′	8°56′	19°09	..	..	Y 200	300	60	..	..	..	1	..
1105	11/9 21	8⁰⁰ p.m.	40°52′	10°06′	19°73	13°26	12°00	Y 200	300	60	..	..	1	..	..
1349	21/5 22	2³⁰ a.m.	36°16′	74°33′	14°60	12°00	11°29	S 200	300	150	1	..	1	..	..
1386	24/6 22	9⁰⁰ p.m.	45°15′	8°43′	16°60	..	..	S 150	600	120	..	3	2	..	..
»	»	»	..	..	..	..	..	S 150	800	120	..	..	..	1	..

Record of the hauls of *Paralepis coregonoides coregonoides* made by the "Dana", 1921—22.

Station No.	Date	Hour	Position		Temperature			Gear	Wire out Meters	Duration of haul in minutes	Sizes (mm)				
			Lat.	Long.	Surface	150 m.	200 m.				< 5	5—8	8—10	10—15	15—25
			N.	W.											
1119	23/9 21	7⁰⁰ p.m.	36°08′	0°30′	23°21	13°88	13°27	S 200	300	90	..	..	..	1	1
1120	24/9 21	4⁴⁰ a.m.	36°24′	1°00′	22°08	13°12	13°04	S 200	250	120	..	..	..	..	1
				E.											
1122	26/9 21	0¹⁰ a.m.	37°12′	1°08′	23°8	..	..	S 200	200	120	..	..	..	1	..
»	»	»	..	..	..	..	..	S 200	300	120	..	10	8	8	3
1123	26/9 21	6⁴⁰ p.m.	37°48′	2°44′	24°50	13°05	13°01	S 200x	200	120	..	..	2	8	3
»	»	»	..	..	..	..	..	S 200	300	120	..	5	2	19	14
1126	1/10 21	3¹⁰ a.m.	37°06′	2°25′	22°9	13°10	13°04	S 200x	250	120	..	..	1	3	..
»	»	»	..	..	..	..	..	S 200	300	120	..	..	..	3	1
1128	1/10 21	9⁵⁰ p.m.	36°46′	0°16′	22°60	..	..	S 200	400	60	..	22	14	33	3
»	»	»	..	..	..	..	..	S 200	500	60	..	..	2	11	6
				W.											
1129	2/10 21	3²⁰ a.m.	36°43′	0°23′	23°60	..	..	S 200	300	120	..	1	3	52	15
1131	2/10 21	11¹⁰ p.m.	36°11′	2°12′	22°10	..	..	S 200	400	60	..	..	..	2	1
1135	4/10 21	3⁴⁵ a.m.	36°04′	5°05′	22°20	..	..	S 200	250	120	..	..	1	.	..

Record of the hauls of *Paralepis coregonoides borealis.*

Station No.	Date	Hour	Position Lat. N.	Position Long. W.	Temperature Surface	Temperature 100 m.	Temperature 200 m.	Gear	Wire out Meters	Duration of haul in minutes	Sizes (mm) < 5	5-8	8-10	10-15	15-25	25-40	> 40
90.05	21/6 05	7³⁰ p.m.	47°47′	8°00′	14°40	..	..	Y 330	500	120	..	..	..	..	1	..	..
52.06	21/5 06	6¹⁰ a.m.	48°43′	12°05′	11°71	..	..	Y 330	300	120	..	..	..	..	3	..	3
55.06	21/5 06	9⁵⁵ p.m.	49°23′	12°12′	11°34	..	..	Y 330	300	120	..	..	..	..	5	..	..
61.06	31/5 06	7⁴⁵ a.m.	51°04′	11°39′	..	..	..	Y 330	300	120	..	..	..	..	4	..	..
358	1/4 11	1³⁰ a.m.	32°50′	10°40′	16°0	..	..	S 100	38	90	..	..	..	..	1	..	..
398	26/10 11	0⁴⁰ a.m.	36°48′	14°22′	19°5	..	..	S 150	56	30	..	..	..	1	1	..	..
399	26/10 11	9¹⁰ p.m.	34°23′	15°31′	20°6	..	..	S 150	56	30	..	..	..	1	..	..	..
413	23/11 11	7¹⁵ p.m.	38°06′	25°37′	18°0	..	..	S 150	34	30	..	..	..	2	..	..	..
713	23/3 13	11⁰⁰ p.m.	38°44′	69°3′	8°4	..	..	S 150	141	30	..	..	..	..	1	..	..
716	26/3 13	9³⁰ p.m.	39°43′	53°38′	15°0	..	..	S 150	132	30	..	..	..	..	2	..	..
744	30/7 13	8⁰⁰ p.m.	37°14′	13°48′	20°0	..	..	S 150	220	35	..	..	..	1	1	..	..
1012	16/8 13	0¹⁵ a.m.	39°39′	27°38′	..	..	..	P 150	150	120	..	..	1	1	2	..	..
824	3/4 20	4⁰⁰ a.m.	35°24′	12°36′	15°2	14°6	13°3	S 200	100	120	..	..	..	2	3	..	..
825	4/4 20	3⁴⁵ a.m.	35°07′	15°19′	16°0	15°7	14°9	S 200	200	120	..	..	..	2	4	..	..
826	5/4 20	4⁰⁰ a.m.	33°22′	16°09′	16°5	16°1	14°31	S 200	300	120	..	..	1	7	22	..	..
827	9/4 20	4⁰⁰ a.m.	29°30′	16°15′	17°6	17°0	15°6	P 150	10	120	..	..	..	..	1	..	..
»	»	»	..	..	..	..	..	S 200	300	120	..	..	..	..	1	..	..
900	30/8 20	8³⁰ p.m.	47°52′	17°50′	16°0	..	..	S 150	150	120	..	..	..	1	..	..	..
1103	9/9 21	7⁴⁵ p.m.	45°46′	8°56′	19°09	11°87	11°50	S 200×	100	60	..	..	..	..	1	..	..
»	»	9⁵⁰ p.m.	..	..	..	..	..	Y 200	100	30	..	..	..	1	3	..	..
1107	13/9 21	10⁵⁰ p.m.	36°28′	8°38′	19°87	15°16	13°41	S 200	75	120	..	..	..	1	..	..	..
»	»	7³⁰ p.m.	..	..	..	..	..	S 200	100	120	..	..	..	4	..	..	..
»	»	10⁵⁰ p.m.	..	..	..	..	..	S 200	100	120	..	..	..	..	2	..	..
»	»	»	..	..	..	..	..	S 200	125	120	..	..	..	2	1	..	..
»	»	7³⁰ p.m.	..	..	..	..	..	S 200×	200	120	2	5	6	8	8	..	..
»	»	»	..	..	..	..	..	Y 200	300	120	2	8	9	3	1	..	..
1108	14/9 21	11³⁰ p.m.	35°11′	8°28′	21°41	15°52	13°88	S 200	100	60	..	..	..	1	..	..	..
»	»	8¹⁵ p.m.	..	..	..	..	..	S 200×	200	120	..	..	2	16	3	..	..
»	»	11³⁰ p.m.	..	..	..	..	..	Y 200	200	60	..	..	24	25	1	..	..
»	»	8¹⁵ p.m.	..	....	..	..	..	Y 200	300	120	..	2	2	15	12	..	..
1110	15/9 21	7²⁵ p.m.	34°18′	8°10′	22°76	15°75	14°14	S 200	200	120	..	1	..	..	1	..	..
»	»	»	..	..	..	..	..	Y 200	300	120	5	32	28	39	..	..	..
1113	17/9 21	11⁵⁰ p.m.	36°10′	6°42′	22°28	15°31	13°82	Y 200	300	120	4	28	29	40	2	..	..
1139	11/10 21	0¹⁰ a.m.	35°37′	7°24′	21°80	..	..	S 200	200	60	..	3	7	15	2	..	..
»	»	»	..	..	..	..	..	S 200	300	60	..	11	38	97	7	..	..
1140	13/10 21	11³⁰ p.m.	32°45′	16°20′	21°60	..	..	S 200	300	120	..	1	1	..	..	..	..
»	14/10 21	2³⁰ a.m.	..	..	..	..	..	S 200	300	120	..	..	1	2	..	..	..
»	13/10 21	11³⁰ p.m.	..	..	..	..	..	S 200	400	120	2	18	15	9	1	..	..
»	14/10 21	2³⁰ a.m.	..	..	..	..	..	S 200	400	120	..	5	7	9	..	..	..
1141	14/10 21	5⁴⁵ p.m.	34°15′	16°53′	21°4	..	..	S 200	200	135	..	..	..	6	3	..	..
»	»	»	..	..	..	..	..	S 200	300	135	..	..	1	8	5	..	..
»	15/10 21	3⁰⁰ a.m.	..	..	..	..	..	S 200	350	180	..	2	..	1	..	..	..
»	»	»	..	..	..	..	..	S 200	400	180	..	..	..	..	7	..	..
»	14/10 21	5⁴⁵ p.m.	..	..	..	..	..	S 200	400	135	1	5	22	29	16	..	..
»	»	9⁰⁰ p.m.	..	..	..	..	..	S 200	500	120	..	11	30	12	17	..	..
»	15/10 21	3⁰⁰ a.m.	..	..	..	..	..	S 200	500	180	..	24	29	35	6	..	..
»	14/10 21	11⁵⁵ p.m.	..	..	..	..	..	S 200	600	120	..	..	13	160	110	..	..
1349	21/5 22	2³⁰ a.m.	36°16′	74°33′	14°60	12°00	11°29	S 200	300	150	..	..	..	..	1	..	..
1374	14/6 22	10⁴⁵ p.m.	37°40′	26°00′	..	..	..	S 200	200	120	..	..	..	..	1	..	..
1377	15/6 22	9⁰⁰ p.m.	37°40′	26°00′	19°30	..	..	S 200	300	180	..	..	..	..	1	..	..
1380	19/6 22	9⁰⁰ p.m.	39°26′	21°51′	17°80	..	..	S 200	200	60	..	..	..	1	..	..	..

Record of the hauls of *Paralepis brevis*.

Station No.	Date	Hour	Position Lat. N.	Position Long. W.	Temperature 150 m.	Temperature 200 m.	Temperature 300 m.	Gear	Wire out Meters	Duration of haul in minutes	Sizes (mm) 5-6	6-8	8-10	10-15	15-25	25-40	> 40
1014	26/8 13	0³⁰ a.m.	33°06′	31°08′	..	..	..	P 150	300	180	..	..	..	1	..	..	..
1018	6/9 13	0³⁰ a.m.	28°37′	39°36′	..	..	..	S 150	300	240	..	..	..	2	..	..	..
1021	14/9 13	0³⁰ a.m.	37°54′	46°47′	..	..	..	PS 150	600	240	..	..	..	1	..	..	..
855	9/6 20	0²⁰ a.m.	29°15′	59°45′	..	..	..	S 200	500	180	..	..	1	..	..	..	..
856	11/6 20	2⁰⁰ p.m.	30°47′	60°33′	..	..	..	P 150	200	120	..	..	8	1	..	..	..
857	13/6 20	1³⁰ a.m.	30°47′	62°27′	..	..	..	S 200	200	120	..	..	..	1	..	..	..
1107	13/2 21	7³⁰ p.m.	36°28′	8°38′	..	13°41	..	Y 200	300	120	..	..	..	3	..	..	..
1152	23/10 21	4⁰⁰ a.m.	30°17′	20°44′	16°65	16°10	14°78	S 200	600	60	..	1	1	2	..	..	..
»	»	7³⁰ p.m.	..	..	..	..	..	S 150	3000	180	..	..	..	..	..	2	..
»	»	7³⁰ p.m.	..	..	..	..	..	S 150	5000	180	..	..	..	..	..	1	..
1156	25/10 21	4⁴⁰ a.m.	25°11′	20°57′	17°58	16°37	14°54	S 200	600	60	..	..	..	1	..	..	..
»	»	6¹⁰ p.m.	..	..	..	..	..	S 150	3000	90	..	..	..	..	..	..	2
»	»	»	..	..	..	..	..	S 150	4000	90	..	..	..	..	..	1	..
1157	27/10 21	2³⁰ a.m.	21°57′	22°58′	17°64	16°92	14°86	S 200	600	120	..	..	..	1	..	..	..
»	»	4³⁰ p.m.	..	..	..	..	..	S 150	3000	180	..	..	..	..	2	1	..
»	»	»	..	..	..	..	..	S 150	4000	180	..	..	..	..	1	1	..
1159	29/10 21	4⁵⁰ p.m.	17°55′	24°35′	16°71	14°53	12°37	S 150	4000	180	..	..	..	1	1	..	..
1185	27/11 21	5⁴⁵ p.m.	17°41′	60°58′	22°09	20°21	16°83	S 150	5000	240	..	..	..	..	..	1	..
1189	8/12 21	2⁴⁰ p.m.	17°58.5′	64°41′	22°49	20°55	16°71	S 150	3000	300	..	..	..	..	..	1	..
1269	16/3 22	0⁴⁰ a.m.	17°13′	64°58′	21°77	19°02	16°16	S 200	600	120	3	9	17	1	..	..	..
»	15/3 22	6⁰⁰ p.m.	..	..	..	..	..	S 150	3000	180	..	1	1	..	..	..	..
1273	24/3 22	11¹⁵ p.m.	17°43′	64°56′	..	..	..	S 200	700	120	..	..	..	2	..	..	..
1274	27/3 22	7⁰⁰ p.m.	17°43′	64°56′	..	..	..	S 200	600	60	..	2	2	..	..	..	..
1278	29/3 22	7⁰⁰ p.m.	17°43′	64°56′	..	..	..	S 200	600	120	..	..	6	..	..	..	..
1280	31/3 22	8¹⁵ p.m.	17°43′	64°56′	..	..	..	S 200	600	120	..	..	4	4	..	..	..
1281	1/4 22	8²⁰ p.m.	17°43′	64°56′	..	..	..	S 200	600	120	..	..	3	..	..	..	..
1291	15/4 22	7³⁰ p.m.	17°43′	64°56′	..	..	..	S 200	600	120	..	..	1	..	..	..	..
1293	17/4 22	7⁴⁰ p.m.	17°43′	64°56′	..	..	..	S 200	600	120	..	..	..	1	..	..	..
1314	22/4 22	7⁵⁰ p.m.	17°43′	64°56′	..	..	..	S 200	600	60	..	..	2	..	..	..	..
1322	30/4 22	11⁰⁰ p.m.	27°02′	53°39′	20°45	18°95	17°63	P 150	400	60	2	6	2	..	..	..	..
»	29/4 22	9⁴⁵ p.m.	..	..	..	..	..	P 150	500	60	1	..	8	..	..	..	..
»	30/4 22	11⁰⁰ p.m.	..	..	..	..	..	P 150	500	60	..	..	..	1	..	..	..
»	29/4 22	7⁰⁰ p.m.	..	..	..	..	..	S 200	600	60	..	2	5	..	..	..	..
»	30/4 22	5¹⁵ a.m.	..	..	..	..	..	P 150	700	120	..	..	..	3	..	..	..
1323	1/5 22	7⁰⁰ p.m.	27°17′	54°35′	..	..	..	S 200	200	120	..	..	..	1	..	..	..
»	»	»	..	..	..	..	..	S 200	300	120	..	..	..	1	..	..	..
»	»	2²⁰ p.m.	..	..	..	..	..	P 150	500	120	2	2	1	..	..	..	..
»	»	»	..	..	..	..	..	P 150	600	120	..	2	8	..	..	..	..
»	»	»	..	..	..	..	..	P 150	700	120	..	..	..	1	..	..	..
»	»	7⁰⁰ p.m.	..	..	..	..	..	S 200	700	120	..	..	3	2	..	..	..
»	»	9⁴⁵ p.m.	..	..	..	..	..	S 200	700	..	..	..	1	..	..	..	..
1324	2/5 22	9⁵⁰ a.m.	27°27′	52°43′	..	..	..	P 150	500	60	..	..	1	..	..	..	..
1325	2/5 22	4²⁰ p.m.	27°20′	51°54′	..	..	..	P 150	600	60	..	..	1	1	..	..	..
1327	3/5 22	10¹⁵ a.m.	27°34′	51°47′	..	..	..	P 150	400	60	..	1	..	2	..	..	..
	»	7³⁰ a.m.	..	..	..	..	..	P 100	450	90	..	..	1	2	..	..	..
	»	»	..	..	..	..	..	P 150	600	90	..	1	1	..	..	..	..
1328	3/5 22	5⁰⁰ p.m.	27°05′	52°11′	..	..	..	P 150	500	90	2	4	4	..	..	..	..
»	»	»	..	..	..	..	..	P 100	550	90	1	3	2	4	..	..	..
	»	»	..	..	..	..	..	P 150	600	90	..	..	2	1	..	..	..
»	»	8¹⁰ p.m.	..	..	..	..	..	P 150	700	90	..	..	3	..	..	..	..
1329	4/5 22	8⁴⁵ a.m.	26°37′	53°22′	..	..	..	P 150	500	90	2	1	..	..	..	..	..
	»	»	..	..	..	..	..	P 150	600	90	2	9	6	2	..	..	..
	»	»	..	..	..	..	..	P 150	700	90	..	..	..	1	..	..	..
1330	4/5 22	8¹⁵ p.m.	26°37′	54°45′	..	..	..	P 150	400	90	1	2	7	3	..	..	..

Station No.	Date	Hour	Position Late	Position Long.	Temperature 150 m.	Temperature 200 m.	Temperature 300 m.	Gear	Wire out Meters	Duration of haul in minutes	Sizes (mm) 5-6	6-8	8-10	10-15	15-25	25-40	> 40
			N.	W.													
1330	4/5 22	8[15] p.m.	26°37′	54°45′	..	..	..	P 150	500	90	..	1	8	1	..	..	..
»	»	»	..	..	..	..	..	P 150	600	90	..	1	3	..	..	..	..
»	»	»	..	..	..	..	..	P 150	700	90	..	..	2	..	..	..	..
1332	5/5 22	8[15] p.m.	26°58′	56°58′	..	..	..	P 150	400	90	..	1	5	..	..	..	..
1333	6/5 22	8[40] a.m.	27°24′	57°04′	18°73	18°11	17°30	P 150	400	90	2	3	5	..	..	..	..
»	»	»	..	..	..	..	..	P 150	500	90	1	2	2	..	..	..	..
1334	7/5 22	6[15] a.m.	27°28′	59°29′	..	..	..	P 100	400	120	3	2	..	..	..	..	..
»	»	2[20] a.m.	..	..	..	..	..	S 200	600	120	..	..	9	2	..	..	..
»	»	6[15] a.m.	..	..	..	..	..	P 150	600	120	..	..	1	..	..	..	..
1335	8/5 22	6[50] p.m.	28°02′	62°26′	18°89	18°39	17°59	P 150	300	60	9	10	1	..	..	..	..
»	»	»	..	..	..	..	..	P 150	400	60	1	..	7	..	..	..	..
	»	»	..	..	..	..	..	P 150	500	60	..	2	4	..	..	..	..
	»	2[15] a.m.	..	..	..	..	..	S 150	600	180	..	..	..	2	..	..	..
»	»	6[45] a.m.	..	..	..	..	..	P 150	800	120	..	..	3	..	..	..	..
1336	9/5 22	7[30] a.m.	28°15′	63°40′	..	..	..	P 150	500	60	3	..	2	..	..	..	..
1337	9/5 22	6[00] p.m.	29°36′	64°01′	..	..	..	P 150	400	60	..	..	..	1	..	..	..
»	»	8[30] p.m.	..	..	..	..	..	S 150	600	120	..	..	37	4	..	..	..
1345	16/5 22	7[30] p.m.	35°07′	72°38′	..	..	..	S 150	600	120	..	..	1	..	..	..	..
»	»	»	..	..	..	..	..	E 300	1000	120	..	..	..	1	..	..	..
1353	23/5 22	6[00] p.m.	33°51′	66°43′	..	..	..	P 100	600	60	..	..	..	1	..	..	..
1356	1/6 22	2[30] a.m.	29°56′	59°33′	19°20	18°51	17°61	S 200	300	120	..	..	..	1	..	..	..
»	»	»	..	..	..	..	..	S 150	600	120	..	..	1	..	..	..	..
1358	3/6 22	1[50] a.m.	28°15′	56°00′	..	..	..	S 150	600	120	..	..	2	..	..	..	..
»	2/6 22	3[30] p.m.	..	..	..	..	..	S 150	2000	360	..	..	1	..	..	..	..
1359	3/6 22	0[50] p.m.	27°35′	55°03′	..	..	..	P 100	400	60	..	1	..	..	..	..	..
1362	6/6 22	2[30] a.m.	28°57′	47°24′	18°55	17°77	16°83	S 150	600	120	..	..	2	3	..	..	..
1363	7/6 22	2[30] a.m.	30°25′	44°46′	..	..	..	S 150	600	120	..	2	8	2	..	..	..
1364	7/6 22	4[15] p.m.	31°22′	43°11′	..	..	..	P 150	300	45	..	..	..	1	..	..	..
»	»	»	..	..	..	..	..	P 150	400	45	..	..	..	1	..	..	..
»	»	»	..	..	..	..	..	P 100	600	45	..	..	1	..	..	..	..
1367	10/6 22	2[30] a.m.	33°42′	36°16′	16°64	16°39	15°71	S 150	800	120	..	1	2	..	..	..	..
1368	11/6 22	2[30] a.m.	34°40′	33°16′	..	..	..	S 150	600	120	..	..	..	1	..	..	..

Record of the hauls of *Paralepis sphyrænoides* (excl. the hauls made by the "Thor", 1908—10).

Station No.	Date	Hour	Position Lat.	Position Long.	Temperature Surface	Temperature 25 m.	Temperature 50 m.	Gear	Wire out Meters	Duration of haul in minutes	Sizes (mm) < 10	10-15	15-25	25-40	> 40
			N.	W.											
190	11/9 06	0[45] a.m.	46°30′	7°00′	18°82	..	..	Y 330	65	120	..	..	..	..	1
262	15/3 11	7[00] p.m.	36°13′	33°50′	17°4	..	..	S 100	47	30	..	1	3	..	..
263	16/3 11	7[00] p.m.	36°42′	30°36′	16°9	..	..	S 100	47	30	..	1	..	1	..
266	21/3 11	7[00] p.m.	40°47′	21°10′	14°2	..	..	S 100	47	30	..	..	..	1	..
377	23/7 11	8[05] p.m.	31°23′	18°08′	21°0	..	..	S 200	15	30	..	1	..	..	..
396	6/12 11	9[00] p.m.	35°27′	44°04′	20°5	..	..	S 150	38	30	..	..	1	..	..
397	8/12 11	8[00] p.m.	40°43′	35°06′	17°5	..	..	S 150	45	30	..	2	2	..	..
413	23/11 11	7[15] p.m.	38°06′	25°37′	18°0	..	..	S 200	17	30	..	..	3	..	..
»	»	»	..	..	..	..	..	S 150	34	30	..	9	6	..	..
416	3/1 12	7[15] p.m.	36°22′	43°42′	18°0	..	..	S 150	34	30	..	..	1	..	..
420	20/1 12	9[00] p.m.	36°35′	29°09′	15°0	..	..	S 150	66	30	..	..	4	..	..
448	5/3 12	0[35] a.m.	38°02′	24°36′	14°5	..	..	S 150	95	30	..	1	..	..	..
449	5/3 12	9[30] p.m.	39°11′	22°30′	13°7	..	..	S 200	47.5	30	..	..	..	1	..
492	27/5 12	9[00] p.m.	39°38′	37°37′	18°0	..	..	S 150	66	30	..	..	1	..	..

Station No.	Date	Hour	Position		Temperature			Gear	Wire out Meters	Duration of haul in minutes	Sizes (mm)				
			Lat.	Long.	Surface	25 m.	50 m.				< 10	10-15	15-25	25-40	> 40
			N.	W.											
510	24/4 12	3^00 a.m.	39°05′	19°06′	15°0	..	..	S 100	76	60	..	..	..	1	..
519	6/8 12	10^00 p.m.	48°30′	23°30′	15°0	..	..	S 100	28	45	..	..	..	..	1
697	22/2 13	5^00 a.m.	36°05′	4°40′	13°5	..	..	S 200	95	30	2	..	..	..	..
720	21/2 13	8^00 p.m.	34°53′	14°55′	16°5	..	..	S 150	120	35	..	1	..	1	..
758	11/11 13	10^30 p.m.	37°32′	0°36′	..	..	..	S 150	220	40	..	5	5	..	..
1009	9/9 13	11^45 p.m.	45°38′	32°37′	20°1	..	..	S 200	65	120	..	..	1	4	..
1010	10/8 13	0^30 a.m.	44°57′	32°12′	20°8	..	..	PS 150	300	120	..	..	..	..	1
1011	13/8 13	0^30 a.m.	42°38′	30°42′	22°1	..	..	S 150	25	240	..	1	3	..	..
»	»	»	..	..	..	..	..	S 200	65	240	..	..	..	1	..
823	1/4 20	8^30 p.m.	35°35′	8°50′	15°9	..	..	S 200	100	60	..	..	4	4	..
»	»	10^30 p.m.	..	..	..	..	..	S 200	150	60	..	..	5	2	..
824	3/4 20	4^00 a.m.	35°24′	12°36′	15°2	..	..	P 150	10	120	..	..	1	..	..
»	»	»	..	..	..	..	..	S 200	50	120	..	..	1	..	..
»	»	»	..	..	..	..	..	S 200	100	120	..	1	1	..	..
825	4/4 20	3^45 a.m.	35°07′	15°19′	16°0	..	..	S 200	200	120	..	..	1	..	..
829	13/4 20	8^30 p.m.	25°07′	19°20′	..	..	..	S 200	300	120	..	..	2	..	..
900	30/8 20	8^30 p.m.	47°52′	17°50′	16°0	..	..	S 150	50	120	..	4	2	4	..
»	»	»	..	..	..	..	..	S 200	100	120	14	54	48	1	..
»	»	»	..	..	..	..	..	S 150	150	120	..	4	..	..	..
1103	9/9 21	7^45 p.m.	45°46′	8°56′	19°09	18°43	14°62	S 200x	100	60	1	..	3	8	1
1107	13/9 21	7^30 p.m.	36°28′	8°38′	19°87	18°19	16°36	S 200	25	120	..	..	1	..	..
»	»	»	..	..	..	..	..	S 200	50	120	..	..	2	..	..
»	14/9 21	3^00 a.m.	..	..	..	..	..	S 200	50	120	..	..	..	1	..
»	»	»	..	..	..	..	..	S 200	75	120	..	..	..	2	1
»	13/9 21	7^30 p.m.	..	..	..	..	..	S 200	100	120	..	1	..	..	..
»	»	10^50 p.m.	..	..	..	..	..	S 200	100	120	..	..	2	..	..
»	14/9 21	3^00 a.m.	..	..	..	..	..	S 200	100	120	..	..	2	3	..
»	13/9 21	10^50 p.m.	..	..	..	..	..	S 200	125	120	..	1	7	1	..
»	»	7^30 p.m.	36°28′	8°33′	..	..	..	Y 200	300	120	..	..	..	..	1
1108	14/9 21	11^30 p.m.	35°11′	8°28′	21°41	19°79	17°02	S 200	100	60	..	2	..	..	..
1110	15/9 21	7^25 p.m.	34°18′	8°10′	22°76	..	17°11	S 200	100	120	..	1	..	..	..
1114	20/9 21	0^45 a.m.	35°52′	6°34′	..	..	..	Y 200	300	120	..	..	..	1	..
1116	21/9 21	2^10 a.m.	35°18′	6°51′	..	..	..	S 200	150	120	..	..	5	1	..
»	20/9 21	7^30 p.m.	..	..	..	..	..	S 200	300	120	..	..	3	3	..
1119	23/9 21	7^00 p.m.	36°08′	0°30′	23°21	16°96	15°70	S 200	300	90	..	4	17	2	..
»	»	»	..	..	..	..	..	S 200	200	90	..	5	20	7	2
»	»	»	..	..	..	..	..	S 200	100	90	..	..	7	3	..
				E.											
1122	26/9 21	0^10 a.m.	37°12′	1°08′	23°8	..	..	S 200	200	120	..	3	5	2	..
1123	26/9 21	6^40 p.m.	37°48′	2°44′	24°50	19°65	15°08	S 200x	200	120	1	.	2	1	
1124	27/9 21	3^20 a.m.	37°15′	2°55′	..	..	..	S 200	200	120	1	7	9	..	.
1126	1/10 21	3^10 a.m.	37°06′	2°25′	22°9	19°21	15°68	S 200	200	120	..	11	24	2	.
»	»	»	..	..	..	..	..	S 200x	250	120	..	5	6	1	..
»	»	»	..	..	..	..	..	S 200	300	120	..	1	2	..	.
1128	1/10 21	9^50 p.m.	36°46′	0°16′	22°60	..	..	S 200	400	60	..	..	1	1	..
				W.											
1129	2/10 21	3^20 a.m.	36°43′	0°23′	23°60	..	..	S 200	300	120	1	..	1	1	..
1131	2/10 21	11^10 p.m.	36°11′	2°12′	22°10	..	..	S 200	100	60	.	.	.	1	1
1139	11/10 21	0^10 a.m.	35°37′	7°24′	21°80	..	..	S 200	200	60	.	2	..	..	.
»	»	»	..	..	..	..	..	S 200	300	60	..	1	2	..	.
1141	14/10 21	5^45 p.m.	34°15′	16°53′	21°4	..	..	S 200	100	135	..	1	..	..	.
»	15/10 21	3^00 a.m.	..	..	..	..	..	S 200	200	180	.	6	..	1	..
»	»	»	..	..	..	..	..	S 200	350	180	1	1	..	..	..
»	14/10 21	5^45 p.m.	..	..	..	..	..	S 200	400	135	1	..	..	..	.

Station No.	Date	Hour	Position Lat.	Position Long.	Temperature Surface	Temperature 25 m.	Temperature 50 m.	Gear	Wire out Meters	Duration of haul in minutes	Sizes (mm) < 10	10-15	15-25	25-40	> 40
			N.	W.											
1141	$^{15}/_{10}$ 21	3^{00} a.m.	34°15′	16°53′	..	..	..	S 200	500	180	2	2	1	..	..
»	$^{14}/_{10}$ 21	11^{55} p.m.	..	..	..	..	..	S 200	600	120	..	..	..	1	..
1366	$^{9}/_{6}$ 22	2^{30} a.m.	32°30′	40°04′	21°60	..	..	S 200	50	120	..	..	5	5	..
»	»	»	..	..	..	..	..	S 200	100	120	..	..	1	..	..
»	»	»	..	..	..	..	..	S 200	300	120	..	..	..	2	..
»	»	»	..	..	..	..	..	S 150	600	120	..	..	..	1	..
1367	$^{10}/_{6}$ 22	2^{30} a.m.	33°42′	36°16′	20°93	20°54	18°93	S 200	50	120	..	..	..	1	..
1369	$^{12}/_{6}$ 22	2^{30} a.m.	35°44′	29°33′	20°22	19°14	17°68	S 200	200	120	..	..	..	1	..
1371	$^{13}/_{6}$ 22	8^{20} p.m.	36°41′	26°21′	19°90	..	..	S 200	300	120	..	..	..	3	..
1372	$^{14}/_{6}$ 22	2^{30} a.m.	37°23′	26°02′	19°60	..	..	S 200	300	120	..	..	..	1	..
1374	$^{14}/_{6}$ 22	10^{45} p.m.	37°40′	26°00′	..	..	..	S 200	100	120	..	..	1	4	..
»	»	»	..	..	..	..	..	S 200	200	120	..	..	1	4	..
»	»	»	..	..	..	..	..	S 200	300	120	..	..	..	3	..
»	»	»	..	..	..	..	..	S 150	600	120	..	..	..	1	..
1377	$^{15}/_{6}$ 22	9^{00} p.m.	37°40′	26°00′	19°30	..	..	S 200	50	180	..	..	..	6	..
»	$^{16}/_{6}$ 22	1^{15} a.m.	..	..	..	..	..	S 200	50	180	..	..	..	1	..
»	»	»	..	..	..	..	..	S 200	100	180	..	1	..	1	..
»	$^{15}/_{6}$ 22	9^{00} p.m.	..	..	..	..	..	S 200	200	180	..	..	..	4	..
»	$^{16}/_{6}$ 22	1^{15} a.m.	..	..	..	..	..	S 200	200	180	..	..	..	1	..
»	$^{15}/_{6}$ 22	9^{00} p.m.	..	..	..	..	..	S 200	300	180	..	..	1	2	..
»	$^{16}/_{6}$ 22	1^{15} a.m.	..	..	..	..	..	S 200	300	180	..	..	..	1	..
1378	$^{17}/_{6}$ 22	7^{45} p.m.	37°44′	25°56′	19°20	..	..	S 200	50	120	..	..	..	3	..
»	»	10^{45} p.m.	..	..	..	..	..	S 200	50	120	..	..	..	1	..
»	$^{18}/_{6}$ 22	1^{30} a.m.	..	..	..	..	..	S 200	50	240	..	..	..	5	1
»	$^{17}/_{6}$ 22	10^{45} p.m.	..	..	..	..	..	S 200	100	120	..	..	..	1	..
»	$^{18}/_{6}$ 22	1^{30} a.m.	..	..	..	..	..	S 200	100	240	..	..	..	4	..
»	$^{17}/_{6}$ 22	7^{45} p.m.	..	..	..	..	..	S 200	200	120	..	..	..	2	..
»	»	10^{45} p.m.	..	..	..	..	..	S 200	200	120	..	..	..	2	..
»	$^{18}/_{6}$ 22	1^{30} a.m.	..	..	..	..	..	S 200	200	240	..	..	..	4	..
»	$^{17}/_{6}$ 22	7^{45} p.m.	..	..	..	..	..	S 200	300	120	..	..	..	1	..
»	»	10^{45} p.m.	..	..	..	..	..	S 200	300	120	..	1	..	5	..
1379	$^{18}/_{6}$ 22	7^{45} p.m.	38°02′	25°52′	18°93	18°17	17°03	S 200	100	120	..	..	..	1	..
»	»	»	..	..	..	..	..	S 200	300	120	..	..	..	1	..
1380	$^{19}/_{6}$ 22	9^{00} p.m.	39°26′	21°51′	17°80	..	..	S 200	100	60	..	..	1	8	1
»	»	»	..	..	..	..	..	S 200	200	60	..	4	3	6	..
»	»	»	..	..	..	..	..	S 150	600	60	..	..	..	1	..
1382	$^{20}/_{6}$ 22	9^{10} p.m.	40°15′	19°29′	17°40	..	..	S 150	100	30	..	..	4	2	..
»	»	»	..	..	..	..	..	S 150	200	30	..	..	..	3	..

Record of the hauls of *Paralepis pseudosphyrænoides thori* (excl. the hauls made by the "Thor" and the S/S "Pangan").

Station No.	Date	Hour	Position Lat.	Position Long.	Temperature Surface	Temperature 25 m.	Temperature 50 m.	Temperature 100 m.	Gear	Wire out Meters	Duration of haul in minutes	Sizes (mm) < 10	10-15	15-20	20-25	25-40	> 40
			N.	W.													
294	$^{21}/_{6}$ 11	9^{00} p.m.	34°59′	42°50′	22°5	..	..	..	S 150	66	30	..	6	6	..	..	..
295	$^{23}/_{6}$ 11	9^{00} p.m.	38°59′	34°02′	19°0	..	..	..	S 150	66	30	..	3	1	..	..	..
330	$^{22}/_{7}$ 11	8^{00} p.m.	32°03′	39°00′	24°5	..	..	..	S 200	17	30	..	5	2	2	..	..
»	»	»	..	..	..	..	..	..	S 200	35	30	1	5	2	..	..	..
376	$^{22}/_{7}$ 11	8^{10} p.m.	34°41′	16°14′	22°3	..	..	..	S 200	15	30	..	1	..	1	..	..
»	»	»	..	..	..	..	..	..	S 100	30	30	..	..	..	1	..	..
377	$^{23}/_{7}$ 11	8^{05} p.m.	31°23′	18°08′	21°0	..	..	..	S 200	15	30	..	2	..	..	..	..

Station No.	Date	Hour	Position Lat.	Position Long.	Temperature Surface	Temperature 25 m.	Temperature 50 m	Temperature 100 m.	Gear	Wire out Meters	Duration of haul in minutes	Sizes (mm) < 10	10-15	15-20	20-25	25-40	>40
			N.	W.													
377	23/7 11	8[05] p.m.	31°23′	18°08′	21°0	..	..	..	S 100	30	30	..	1	..	..	..	..
378	25/7 11	8[05] p.m.	24°25′	21°50′	22°3	..	..	..	S 100	22	30	..	..	1	..	..	..
495	20/6 12	7[45] p.m.	32°05′	37°40′	22°5	..	..	..	S 200	17	30	..	3	8	3	..	..
»	»	»	..	..	..	..	..	..	S 150	85.5	30						
530	9/8 12	4[00] a.m.	36°40′	1°16′	..	..	..	..	S 200	57	30	..	1	2	..	..	..
554	1/9 12	7[40] p.m.	31°30′	43°00′	25°3	..	..	..	..	94	20	..	2	2	..	..	..
559	30/6 12	7[40] p.m.	30°15′	12°23′	21°0	..	..	..	S 150	23	30	..	..	..	1	..	..
560	3/7 12	7[40] p.m.	19°54′	24°34′	21°5	..	..	..	S 150	23	30	1	..	..	..	..	..
565	20/9 12	6[40] p.m.	24°49′	17°26′	22°0	..	..	..	S 100	38	30	..	1	..	..	..	..
566	23/9 12	6[45] p.m.	32°31′	13°45′	22°0	..	..	..	S 100	38	30	..	2	2	..	..	..
584	30/7 12	1[00] a.m.	34°36′	30°24′	..	..	..	..	S 100	47	30	..	1	..	..	..	..
»	»	7[00] p.m.	..	..	..	..	..	..	S 100	55	60						
596	5/9 11	4[00] a.m.	32°46′	28°44′	23°8	..	..	..	S 100	19	70	..	1	..	..	..	..
625	12/10 12	5[00] a.m.	34°15′	32°10′	24°5	..	..	..	S 100	28	180	..	..	1	..	..	..
646	20/10 12	9[12] p.m.	32°10′	17°22′	21°0	..	..	..	S 200	19	45	..	4	..	..	..	..
»	»	»	..	..	..	..	..	..	S 150	56	45	1	..	..	..	..	..
655	24/10 12	7[30] p.m.	36°40′	23°30′	23°0	..	..	..	S 200	23	30	..	..	..	1	..	..
				E.													
660	15/10 12	4[00] a.m.	33°30′	27°14′	..	..	..	..	S 200	..	..	..	1	..	..	..	..
				W.													
661	27/9 12	8[00] p.m.	33°53′	15°50′	21°9	..	..	..	S 150	188	35	..	2	1	..	..	..
733	17/9 12	4[30] p.m.	34°55′	20°01′	23°0	..	..	..	S 100	38	30	..	1	..	1	..	..
766	30/6 13	7[00] p.m.	35°00′	58°00′	..	..	..	..	S 100	66	180	..	2	5	..	..	..
770	6/10 13	7[30] p.m.	33°00′	15°30′	18°0	..	..	..	S 100	66	60	..	3	..	..	..	..
774	13/5 14	9[15] p.m.	30°25′	50°15′	..	..	..	..	S 150	56	30	..	3	..	1	..	..
»	»	»	..	..	..	..	..	..	S 150	150	30	..	1	..	..	..	..
805	27/9 14	7[00] p.m.	31°45′	60°30′	..	..	..	..	S 100	68	130	..	1	4	2	..	..
1013	24/8 13	0[25] a.m.	35°30′	28°37′	23°0	..	..	..	S 100	10	120	..	..	1	..	..	..
»	»	»	..	..	..	..	..	..	S 200	65	120	..	1	..	..	..	..
1014	26/8 13	0[30] a.m.	33°06′	31°08′	24°3	..	..	..	S 200	65	180	1	3	..	..	..	..
»	»	»	..	..	..	..	..	..	S 200	150	180	..	..	..	1	1	..
1015	28/8 13	1[30] a.m.	31°38′	33°06′	24°66	24°61	21°07	17°09	S 200	65	240	..	1	1	..	..	1
1016	31/8 13	0[30] a.m.	29°54′	35°28′	24°6	..	..	..	S 200	25	120	..	1	1	1	..	..
1019	8/9 13	0[30] a.m.	31°06′	41°45′	24°0	..	..	..	S 200	65	240	..	..	..	1	..	..
1020	11/9 13	0[30] a.m.	35°50′	44°55′	24°4	..	..	..	S 200	40	240	..	..	..	2	..	..
»	»	»	..	..	..	..	..	..	S 150	150	240	..	1	1	..	..	..
1021	14/9 13	0[30] a.m.	37°54′	46°47′	23°89	23°76	23°66	19°85	S 200	25	240	..	..	2	..	..	..
»	»	»	..	..	..	..	..	..	S 200	65	240	..	3	1	..	1	..
1023	18/9 13	0[30] a.m.	40°34′	48°53′	19°7	..	..	..	S 200	65	240	..	1	1	..	..	..
1027	26/9 13	8[00] p.m.	39°56′	52°17′	22°6	..	..	..	S 200	80	240	..	1	1	..	..	..
»	27/9 13	0[15] a.m.	..	..	..	..	..	..	S 200	80	240	..	1	2	..	..	..
»	»	4[30] a.m.	..	..	..	..	..	..	S 200	80	240	..	..	1	..	..	..
1028	29/9 13	10[30] p.m.	37°46′	56°11′	24°0	..	..	..	S 200	80	360	..	7	2	1	..	..
1029	30/9 13	8[00] p.m.	36°39′	56°20′	24°5	..	..	..	S 200	65	240	1	3	1	..	..	..
1030	1/10 13	8[20] p.m.	35°31′	55°58′	24°2	..	..	..	S 200	10	240	..	4	1	..	..	..
1031	3/10 13	8[00] p.m.	33°18′	56°03′	25°0	..	..	..	S 150	25	240	..	1	..	..	..	..
»	»	»	..	..	..	..	..	..	S 150	65	240	..	1	..	..	..	..
»	»	»	..	..	..	..	..	..	S 200	80	240	..	2	..	2	..	..
»	»	»	..	..	..	..	..	..	S 200	150	240	..	2	..	2	1	..
1043	24/10 13	8[00] p.m.	31°59′	59°52′	24°9	..	..	..	S 200	150	240	..	1	..	..	..	..
1054	12/11 13	0[20] a.m.	31°58′	58°04′	23°86	23°84	23°71	19°86	S 200	65	240	..	6	1	..	..	..
»	»	»	..	..	..	..	..	..	S 200	80	240	2	1	1	..	..	..
1057	22/11 13	0[20] a.m.	30°23′	48°17′	23°14	23°32	23°27	18°98	S 200	80	240	..	1	1	..	..	..
855	8/6 20	8[00] p.m.	29°15′	59°45′	..	..	..	..	S 200	150	180	..	1	1	..	..	..

Station No.	Date	Hour	Position Lat. N.	Position Long. W.	Temperature Surface	Temperature 25 m.	Temperature 50 m.	Temperature 100 m.	Gear	Wire out Meters	Duration of haul in minutes	Sizes (mm) < 10	10-15	15-20	20-25	25-40	>40
857	13/6 20	1³⁰ a.m.	30°47′	62°27′	23°0	..	..	..	S 200	50	120	..	5	..	..	..	..
858	14/6 20	1⁰⁰ a.m.	29°31′	64°00′	23°0	..	..	..	P 150	25	120	..	1	..	..	..	..
859	15/6 20	1⁰⁰ a.m.	29°02′	65°09′	..	..	..	..	S 200	150	120	..	1	..	..	..	..
860	18/6 20	11¹⁰ p.m.	32°30′	64°32′	..	..	..	..	P 150	100	30	8	4	..	..	..	..
861	16/6 20	1³⁰ a.m.	32°30′	64°24′	23°5	..	..	..	S 200	50	120	1	4	1	..	1	1
»	»	»	..	..	..	..	..	..	P 150	100	120	19	..	..	..	3	2
862	20/6 20	1¹⁵ a.m.	31°36′	62°25′	23°5	..	..	..	S 200	150	120	..	..	2	..	2	..
863	21/6 20	1¹⁵ a.m.	30°43′	60°46′	24°5	..	..	..	S 200	50	120	1	..	..	..	..	..
876	2/7 20	8¹⁰ p.m.	30°58′	66°14′	24°5	..	..	..	S 150	150	60	..	1	1	..	..	..
877	8/7 20	11⁰⁰ p.m.	32°37′	63°28′	25°0	..	..	..	S 200	50	120	..	6	13	..	2	..
»	»	»	..	..	..	..	..	..	S 200	100	120	14	4	1	..	1	..
»	»	»	..	..	..	..	..	..	P 150	150	120	2	1	..	..	2	..
878	9/7 20	11¹⁰ p.m.	33°24′	61°05′	25°0	..	..	..	S 200	50	120	..	52	6	..	..	..
»	»	»	..	..	..	..	..	..	S 200	100	120	2	11	..	2	..	..
»	»	»	..	..	..	..	..	..	P 150	150	120	11	6	3	3	..	..
879	10/7 20	11⁰⁰ p.m.	33°46′	58°56′	25°0	..	..	..	S 200	50	120	1	9	8	1	..	..
880	11/7 20	11¹⁵ p.m.	34°35′	56°49′	24°5	..	..	..	S 200	50	120	..	17	38	14	7	..
»	»	»	..	..	..	..	..	..	S 200	100	120	1	6	9	4	15	..
»	»	»	..	..	..	..	..	..	P 150	150	120	..	2	2	..	6	..
881	13/7 20	1³⁰ a.m.	34°42′	54°00′	25°0	..	..	..	S 200	50	120	..	13	26	1	1	..
»	»	»	..	..	..	..	..	..	S 200	100	120	2	8	10	..	4	..
»	»	»	..	..	..	..	..	..	P 150	150	120	2	1	..	1	1	..
882	13/7 20	11³⁰ p.m.	33°00′	54°02′	25°0	..	..	..	S 200	50	120	..	2	11	1	2	..
»	»	»	..	..	..	..	..	..	S 200	100	120	4	5	..	..	2	..
»	»	»	..	..	..	..	..	..	P 150	150	120	6	1	..	1	7	2
883	14/7 20	11¹⁵ p.m.	30°53′	54°07′	25°0	..	..	..	S 200	50	120	1	2	..	3	..	..
»	»	»	..	..	..	..	..	..	S 200	100	120	2	3	2	..	1	..
»	»	»	..	..	..	..	..	..	P 150	150	120	1	1	..	..	..	..
889	21/7 20	8³⁰ p.m.	28°20′	63°50′	26°0	..	..	..	S 150	50	120	..	3	..	1	..	..
»	»	»	..	..	..	..	..	..	P 150	150	120	..	..	2	..	..	..
890	22/7 20	8³⁰ p.m.	28°44′	66°04′	27°0	..	..	..	S 150	50	120	..	5	2	..	..	..
»	»	»	..	..	..	..	..	..	S 200	100	120	3	10	..	..	..	..
891	24/7 20	2⁰⁰ a.m.	29°28′	69°25′	27°0	..	..	..	S 150	50	120	..	3	2	..	..	..
»	»	»	..	..	..	..	..	..	S 200	100	120	..	3	1	..	..	..
892	25/7 20	8³⁰ p.m.	30°49′	73°30′	26°5	..	..	..	S 150	100	120	21	13	..	..	..	..
»	»	»	..	..	..	..	..	..	S 150	150	120	2	6	..	..	..	..
896	16/8 20	8³⁰ p.m.	39°44′	57°21′	24°0	..	..	..	S 200	50	120	1	19	2	..	..	..
»	»	»	..	..	..	..	..	..	S 200	100	120	15	17	..	..	..	..
»	»	»	..	..	..	..	..	..	S 150	150	120	31	..	..	..	1	..
897	18/8 20	8³⁰ p.m.	40°07′	51°02′	24°0	..	..	..	S 150	50	120	1	28	4	..	..	..
»	»	»	..	..	..	..	..	..	S 200	100	120	1	3	..	1	..	..
»	»	»	..	..	..	..	..	..	S 150	150	120	4	..	2	1	..	..
898	21/8 20	8³⁰ p.m.	41°44′	41°02′	22°0	..	..	..	S 200	50	120	1	1	1	..	..	..
»	»	»	..	..	..	..	..	..	S 200	100	120	..	1	3	..	..	..
»	»	»	..	..	..	..	..	..	S 150	150	120	..	3	..	1	..	..
899	24/8 20	8³⁰ p.m.	43°02′	33°21′	19°0	..	..	..	S 150	50	120	..	1	2	..	..	..
1108	14/9 21	8¹⁵ p.m.	35°11′	8°28′	21°41	19°79	17°02	15°52	S 200	25	120	..	1	..	..	1	..
»	»	»	..	..	..	..	..	..	S 200	50	120	..	..	1	..	..	..
»	»	»	..	..	..	..	..	..	S 200x	200	120	..	..	..	1	..	..
1110	15/9 21	7²⁵ p.m.	34°18′	8°10′	22°76	..	17°11	15°75	S 200	25	120	..	1	..	..	..	..
»	»	»	..	..	..	..	..	..	S 200	50	120	..	1	..	..	..	..
»	»	»	..	..	..	..	..	..	S 200	100	120	..	..	1	..	..	..
»	»	»	..	..	..	..	..	..	Y 200	300	120	..	..	..	2	..	1
1113	17/9 21	11⁵⁰ p.m.	36°10′	6°42′	22°28	20°7	16°17	15°31	Y 200	300	120	..	1	1	..	2	..

Station No.	Date	Hour	Position Lat.	Position Long.	Temperature Surface	Temperature 25 m.	Temperature 50 m.	Temperature 100 m.	Gear	Wire out Meters	Duration of haul in minutes	Sizes (mm) < 10	10-15	15-20	20-25	25-40	>40
			N.	E.													
1122	25/9 21	8[00] p.m.	37°12′	1°08′	23°8	..	..	..	S 200	150	60	..	..	..	2	..	..
»	»	9[30] p.m.	..	..	..	..	..	..	S 200	150	120	..	..	1	..	1	..
»	»	»	..	..	..	..	..	..	S 200	200	120	..	..	2	..	1	..
1123	26/9 21	6[40] p.m.	37°48′	2°44′	24°50	19°65	15°08	13°34	S 200	25	120	..	2	7	1	..	..
»	»	»	..	..	..	..	..	..	S 200	50	120	..	3	4	4	2	..
»	»	»	..	..	..	..	..	..	S 200	100	120	2	..	..	..	1	..
»	»	»	..	..	..	..	..	..	S 200×	200	120	..	..	..	..	1	1
»	»	»	..	..	..	..	..	..	S 200	300	120	..	..	..	..	..	1
1124	27/9 21	3[20] a.m.	37°15′	2°55′	..	..	..	..	S 200	100	120	..	2	..	4	..	
»	»	»	..	..	..	..	..	..	S 200	250	120	2	4	5	3	1	..
1126	1/10 21	3[10] a.m.	37°06′	2°25′	22°9	19°21	15°68	13°63	S 200	200	120	..	..	..	1	..	..
				W.													
1139	11/10 21	0[10] a.m.	35°37′	7°24′	21°80	..	..	..	S 200	300	60	..	..	..	..	1	..
1140	13/10 21	11[30] p.m.	32°45′	16°20′	21°60	..	..	..	S 200	50	120	..	2	1	..	..	..
»	»	»	..	..	..	..	..	..	S 200	100	120	..	2	..	..	..	..
»	14/10 21	2[30] a.m.	..	..	..	..	..	..	S 200	50	120	..	1	5	..	..	..
»	»	»	..	..	..	..	..	..	S 200	100	120	..	3	2	1	..	..
»	»	»	..	..	..	..	..	..	S 200	200	120	..	..	..	1	..	..
1141	15/10 21	3[00] a.m.	34°15′	16°53′	21°4	..	..	..	S 200	500	180	..	..	..	..	1	..
1145	19/10 21	4[15] a.m.	32°07′	16°50′	..	..	..	..	S 200	100	120	..	3	..	..	..	..
»	»	1[15] a.m.	..	..	22°10	..	..	..	S 200	200	120	..	..	1	..	..	..
»	»	»	..	..	..	..	..	..	S 200	300	120	..	..	1	..	..	..
»	»	4[15] a.m.	..	..	..	..	..	..	S 200	500	120	..	1	..	..	..	..
1146	19/10 21	8[10] p.m.	32°00′	19°11′	22°00	..	..	..	S 200	100	120	..	..	..	1	..	..
»	»	»	..	..	..	..	..	..	S 200	200	120	..	..	1	..	..	..
»	»	»	..	..	..	..	..	..	S 200	300	120	..	..	..	1	1	..
1147	20/10 21	4[00] a.m.	32°00′	20°01′	22°10	..	..	..	S 200	100	120	..	1	2	..	..	..
»	»	»	..	..	..	..	..	..	S 200	200	120	..	2	..	..	1	..
»	»	»	..	..	..	..	..	..	S 200	300	120	..	2	..	..	..	..
»	»	»	..	..	..	..	..	..	S 200	400	120	..	..	1	..	..	..
1148	20/10 21	8[15] p.m.	32°55′	21°51′	21°90	..	..	..	S 200	400	60	..	..	2	..	..	..
1149	21/10 21	2[45] p.m.	33°22′	21°55′	21°60	..	..	..	S 200	200	60	..	1	..	..	..	..
1152	23/10 21	4[00] a.m.	30°17′	20°44′	22°68	22°26	19°83	17°17	S 200	300	60	..	..	..	..	1	..
1337	9/5 22	8[30] p.m.	29°36′	64°01′	22°40	..	..	..	S 150	50	120	..	1	3	..	..	..
1339	10/5 22	7[30] p.m.	30°00′	64°38′	20°59	19°61	19°37	19°14	S 150	50	120	..	5	2	..	..	..
»	»	»	..	..	..	..	..	..	S 200	150	120	..	..	1	..	..	..
»	»	»	..	..	..	..	..	..	S 200	300	120	..	..	1	..	..	..
1341	14/5 22	7[30] p.m.	33°15′	68°20′	..	..	..	..	S 150	50	120	1	1	..	..	..	..
»	»	»	..	..	..	..	..	..	S 200	100	120	2	..	..	..	..	..
1345	16/5 22	7[30] p.m.	35°07′	72°38′	21°40	..	..	..	S 150	50	120	..	4	..	..	..	..
»	»	»	..	..	..	..	..	..	S 200	100	120	3	..	..	..	..	..
1353	23/5 22	7[50] p.m.	33°51′	66°43′	..	..	..	..	S 150	50	120	2	9	1	..	..	..
»	»	»	..	..	..	..	..	..	S 200	100	120	6	2	..	1	..	..
»	»	»	..	..	..	..	..	..	S 150	600	120	..	..	1	..	..	..
»	»	6[00] p.m.	..	..	21°90	..	..	..	S 150	700	60	..	1	..	..	..	..
1355	30/5 22	8[30] p.m.	31°48′	63°38′	22°30	..	..	..	S 200	200	120	..	1	1	..	..	..
»	»	»	..	..	..	..	..	..	S 150	50	120	..	1	..	..	..	..
»	»	»	..	..	..	..	..	..	S 200	100	120	..	2	1	..	..	..
1356	1/6 22	2[30] a.m.	29°56′	59°33′	22°65	22°41	20°65	19°86	S 150	50	120	..	1	..	..	..	..
»	»	»	..	..	..	..	..	..	S 200	100	120	..	1	..	1	..	..
»	»	»	..	..	..	..	..	..	S 200	150	120	..	2	1	..	..	..
»	»	»	..	..	..	..	..	..	S 200	200	120	..	1	..	..	1	..
»	»	»	..	..	..	..	..	..	S 200	300	120	..	..	..	1	..	..
1358	3/6 22	1[50] a.m.	28°15′	56°00′	23°30	..	..	..	S 150	50	120	..	1	..	..	..	..

Station No.	Date	Hour	Position Lat.	Position Long.	Temperature Surface	Temperature 25 m.	Temperature 50 m.	Temperature 100 m.	Gear	Wire out Meters	Duration of haul in minutes	Sizes (mm) <10	10-15	15-20	20-25	25-40	>40
			N.	W.													
1358	3/6 22	1[50] a.m.	28°15′	56°00′	..	..	..	..	S 200	200	120	..	..	1	..	..	..
1363	7/6 22	2[30] a.m.	30°25′	44°46′	23°30	..	..	..	S 150	50	120	3	2	2	..	..	..
»	»	»	..	..	..	..	..	..	S 200	100	120	3	..	..	..	..	..
»	»	»	..	..	..	..	..	..	S 200	200	120	..	1	..	..	..	..
1365	8/6 22	2[30] a.m.	31°47′	41°41′	21°71	21°26	19°67	18°13	S 200	50	120	1	44	45	..	1	..
»	»	»	..	..	..	..	..	..	S 200	100	120	4	11	..	..	..	..
»	»	»	..	..	..	..	..	..	S 200	200	120	..	3	..	..	..	..
1366	9/6 22	2[30] a.m.	32°30′	40°04′	21°60	..	..	..	S 200	50	120	..	3	7	4	..	..
»	»	»	..	..	..	..	..	..	S 200	100	120	3	2	1	1	..	..
»	»	»	..	..	..	..	..	..	S 150	150	120	..	6	..	..	..	..
»	»	»	..	..	..	..	..	..	S 200	200	120	..	6	2	..	..	..

Record of the hauls of *Paralepis pseudosphyrænoides danæ.*

Station No.	Date	Hour	Position Lat.	Position Long.	Temperature Surface	Temperature 25 m.	Temperature 50 m.	Temperature 100 m	Gear	Wire out Meters	Duration of haul in minutes	Sizes (mm) < 10	10-15	15-20	20-25	25-40
			N.	W.												
396	6/12 11	9[00] p.m.	35°27′	44°04′	20°5	..	..	..	S 150	48	30	..	..	1	..	..
399	26/10 11	9[10] p.m.	34°23′	15°31′	20°6	..	..	..	S 200	Surface	30	1	1	1	..	..
401	1/11 11	0[30] a.m.	30°20′	19°05′	22°1	..	..	..	S 200 / S 150	Surface / 56	30	..	3	2	..	..
402	1/11 11	9[40] p.m.	28°52′	20°36′	22°3	..	..	..	S 150	56	30	..	9	4	..	..
446	24/3 12	1[50] a.m.	30°10′	45°41′	19°5	..	..	..	S 200	47.5	30	..	1	..	..	..
468	8/12 11	6[10] p.m.	34°50′	15°54′	17°6	..	..	..	S 150	15	30	..	1	5	..	..
469	9/12 11	6[10] a.m.	33°20′	16°58′	17°5	..	..	..	S 150	15	30	..	..	1	..	..
»	»	»	..	..	..	..	..	..	S 100	30	30	..	..	1	..	..
828	12/4 20	4[00] a.m.	27°54′	16°35′	18°1	..	18°15	17°85	S 200	300	120	..	..	..	1	..
829	13/4 20	8[30] p.m.	25°07′	19°20′	19°0	..	18°8	18°35	S 200	100	120	..	..	1	..	2
830	15/4 20	2[00] a.m.	24°44′	22°32′	19°5	..	19°3	18°9	S 200	50	120	..	..	1	1	..
»	»	»	..	..	..	..	..	..	S 200	100	120	..	..	..	1	2
831	17/4 20	3[00] a.m.	24°34′	28°04′	20°0	..	19°95	19°7	P 150	50	120	..	..	1	4	..
834	20/4 20	3[00] a.m.	24°20′	35°31′	21°0	..	20°9	20°3	P 150	50	120	..	..	1	2	..
907	8/3 21	8[00] p.m.	27°24′	60°09′	23°5	..	..	..	S 200	200	120	..	..	2	..	..
910	7/3 21	10[30] a.m.	27°43′	57°22′	22°5	..	..	..	S 150	50	120	..	2	..	..	..
»	»	»	..	..	..	..	..	..	S 150	100	120	..	..	2	..	..
1139	11/10 21	0[10] a.m.	35°37′	7°24′	21°80	..	..	..	S 200	150	60	..	..	1	..	..
1140	14/10 21	2[30] a.m.	32°45′	16°20′	21°60	..	..	..	S 200	50	120	6	31	..	..	..
»	»	»	..	..	..	..	..	..	S 200	100	120	6	28	..	..	..
»	»	8[00] p.m.	..	..	..	..	..	..	S 200	200	120	3	24	..	..	..
1145	19/10 21	1[15] a.m.	32°07′	16°50′	22°10	..	..	..	S 200	100	120	..	1	..	..	..
»	»	»	..	..	..	..	..	..	S 200	200	120	1	5	1	1	..
»	»	4[15] a.m.	..	..	..	..	..	..	S 200	100	120	2	51	4	..	..
»	»	»	..	..	..	..	..	..	S 200	200	120	3	15	1	..	..
»	»	»	..	..	..	..	..	..	S 200	500	120	..	2	1	..	..
1146	19/10 21	8[10] p.m.	32°00′	19°11′	22°00	..	..	..	S 200	300	120	..	1	2	..	..
1147	20/10 21	4[00] a.m.	32°00′	20°01′	22°10	..	..	..	S 200	100	120	3	2	..	..	..
»	»	»	..	..	..	..	..	..	S 200	200	120	8	8	1	..	..
»	»	»	..	..	..	..	..	..	S 200	300	120	6	7	2	..	..
»	»	»	..	..	..	..	..	..	S 200	400	120	4	..	..	..	..
1148	20/10 21	8[15] p.m.	32°55′	21°51′	21°90	..	..	..	S 200	400	60	..	1	..	..	..
1149	21/10 21	2[45] p.m.	33°22′	21°55′	21°60	..	..	..	S 200	200	60	..	1	2	..	..

Station No.	Date	Hour	Position Lat.	Position Long.	Temperature Surface	Temperature 25 m.	Temperature 50 m.	Temperature 100 m.	Gear	Wire out Meters	Duration of haul in minutes	Sizes (mm) < 10	10-15	15-20	20-25	25-40
			N.	W.												
1151	22/10 21	5[00] a.m.	30°51′	21°00′	22°40	..	..	..	S 200	150	60	..	1	1	..	..
1152	23/10 21	4[00] a.m.	30°17′	20°44′	22°68	22°26	19°83	17°17	S 200	100	60	2	4	3	..	..
»	»	»	..	..	..	..	..	..	S 200	600	60	..	..	1	..	..
»	22/10 21	7[30] p.m.	..	..	..	..	..	..	S 150	5000	180	..	2	..	..	..
1155	24/10 21	7[15] p.m.	26°15′	20°53′	23°70	..	..	..	S 200	400	60	..	..	1	..	..
1156	25/10 21	4[10] a.m.	25°11′	20°57′	23°90	23°72	22°33	18°50	S 200	100	60	..	..	1	..	..
»	»	»	..	..	..	..	..	..	S 200	300	60	..	1	..	..	..
1157	27/10 21	2[30] a.m.	21°57′	22°58′	24°64	24°58	22°15	18°95	S 200	300	120	..	..	..	2	..
»	»	»	..	..	..	..	..	..	S 200	600	120	..	..	..	1	..
»	»	10[00] p.m.	..	..	..	..	..	..	S 200	800	120	..	..	..	1	..
1159	29/10 21	10[45] p.m.	17°55′	24°35′	25°40	25°42	25°39	18°17	S 200	300	120	..	..	2	..	2
»	»	»	..	..	..	..	..	..	S 200	600	120	..	..	1	..	..
1160	4/11 21	3[00] a.m.	15°50′	26°32′	26°51	26°49	21°83	18°49	S 200	300	120	..	..	..	..	1
1161	5/11 21	3[45] a.m.	14°52′	28°04′	26°10	..	..	..	S 200	100	120	..	3	3	3	1
1341	14/5 22	7[30] p.m.	33°15′	68°20′	..	..	..	..	S 200	150	120	..	..	..	1	..
1342	15/5 22	8[00] p.m.	34°00′	70°01′	20°83	20°58	19°86	18°92	S 150	50	120	..	..	1	..	..
»	»	»	..	..	..	..	..	..	S 200	100	120	1	..	1	..	..
»	»	»	..	..	..	..	..	..	S 200	150	120	..	..	..	1	..
»	»	»	..	..	..	..	..	..	S 200	200	120	..	..	..	2	..
1345	16/5 22	7[30] p.m.	35°07′	72°38′	21°40	..	..	..	S 150	50	120	..	..	..	1	..
1352	21/5 22	9[30] p.m.	35°42′	73°43′	25°60	..	..	..	S 150	50	120	..	2	..	..	..
»	»	»	..	..	..	..	..	..	S 200	100	120	..	3	..	..	..
»	»	»	..	..	..	..	..	..	S 200	150	120	1	2	..	..	..
1353	23/5 22	7[50] p.m.	33°51′	66°43′	21°90	..	..	..	S 200	300	120	..	..	..	..	2

Record of the hauls of *Paralepis affinis.*

Station No.	Date	Hour	Position Lat.	Position Long.	Temperature Surface	Temperature 50 m.	Temperature 75 m.	Temperature 100 m.	Gear	Wire out Meters	Duration of haul in minutes	Sizes (mm) <10	10-15	15-25	25-40	>40
			N.	W.												
437	17/11 11	1[25] a.m.	19°11′	54°15′	26°2	..	..	..	S 150	56	30	..	..	1	..	..
438	17/11 11	9[20] p.m.	19°09′	55°48′	26°7	..	..	..	S 150	56	30	..	..	2	..	..
439	19/11 11	1[20] a.m.	18°58′	59°36′	27°1	..	..	..	S 150	56	30	..	..	2	..	..
»	»	»	..	..	..	..	..	..	S 200	Surface	30	..	1	1	..	..
523	1/5 12	8[00] p.m.	21°50′	21°29′	20°5	..	..	..	S 150	133	35	..	..	..	1	..
648	24/10 12	9[10] p.m.	25°40′	24°20′	23°0	..	..	..	S 150	56	45	..	..	1	..	..
650	28/10 12	9[05] p.m.	20°37′	33°03′	25°2	..	..	..	S 150	75	45	..	1	1	..	..
			S.													
665	9/10 12	8[00] p.m.	4°09′	31°57′	25°7	..	..	..	S 150	188	35	..	..	1	..	..
			N.													
678	8/12 12	1[00] a.m.	26°08′	57°20′	23°0	..	..	..	S 150	178	40	..	1	8	..	..
679	10/12 12	1[00] a.m.	26°10′	65°08′	23°1	..	..	..	S 150	198	35	..	..	1	..	..
687	29/1 13	9[00] p.m.	32°23′	48°08′	20°0	..	..	..	S 150	94	30	..	..	2	..	..
			S.													
748	12/8 13	8[00] p.m.	6°46′	33°14′	25°5	..	..	..	S 150	220	35	..	..	..	1	..
750	14/10 13	8[00] p.m.	0°04′	30°47′	26°0	..	..	..	S 150	220	35	..	..	1	..	..
			N.													
762	15/3 14	9[00] p.m.	27°30′	53°18′	..	..	..	..	S 150	200	30	..	..	1	..	..
772	10/5 14	9[15] p.m.	23°00′	58°58′	..	..	..	..	S 150	150	30	..	..	2	..	..
773	12/5 14	9[15] p.m.	28°00′	53°05′	..	..	..	..	S 150	150	30	..	..	5	..	..
788	7/6 14	9[00] p.m.	28°40′	51°10′	20°7	..	..	..	S 150	150	30	..	..	1	..	..
792	10/6 14	8[20] p.m.	22°50′	59°20′	25°5	..	..	..	S 150	188	40	..	..	1	..	..

Station No.	Date	Hour	Position		Temperature				Gear	Wire out Meters	Duration of haul in minutes	Sizes (mm)				
			Lat.	Long.	Surface	50 m.	75 m.	100 m.				<10	10-15	15-25	25-40	>40
			N.	W.												
793	11/6 14	8¹⁵ p.m.	25°50′	56°30′	25°0	..	..	..	S 150	150	30	..	..	..	3	..
812	9/7 15	9⁰⁰ p.m.	29°20′	40°25′	..	..	..	..	S 150	..	..	..	..	1	2	..
813	11/7 15	9³⁰ p.m.	24°00′	52°30′	..	..	..	..	S 150	..	..	..	2	11	..	..
815	17/6 15	1⁰⁰ a.m.	27°55′	35°17′	23°0	..	..	..	S 150	170	50	..	..	..	1	..
816	19/6 15	4⁰⁰ a.m.	24°32′	44°18′	25°3	..	..	..	S 150	170	55	1	7	6	1	..
818	22/6 15	4⁰⁰ a.m.	20°14′	57°3′	27°0	..	..	..	S 150	170	50	..	2	..	..	..
819	23/6 15	4⁰⁰ a.m.	19°10′	61°4′	27°3	..	..	..	S 150	170	56	..	12	6	..	..
821	27/9 15	7⁰⁰ p.m.	25°28′	50°38′	27°7	..	..	..	S 150	170	55	..	..	1	1	..
1016	31/8 13	0³⁰ a.m.	29°54′	35°28′	24°6	..	..	..	S 200	65	120	..	..	..	1	..
1017	3/9 13	0³⁰ a.m.	28°00′	37°57′	25°0	..	..	..	PS 150	150	240	..	..	..	1	..
»	»	»	..	..	..	..	..	..	S 150	300	240	..	..	..	1	..
1018	6/9 13	0³⁰ a.m.	28°37′	39°36′	25°5	..	..	..	S 100	10	240	..	..	1	..	..
»	»	»	..		..	..	..	..	S 200	65	240	..	9	26	6	..
»	»	»	..	..	..	..	..	..	S 150	300	240	..	..	..	1	..
1019	8/9 13	0³⁰ a.m.	31°06′	41°45′	24°0	..	..	..	S 200	65	240	..	2	6	3	..
»	»	»	..	..	..	..	..	..	PS 150	150	240	..	..	1	..	..
1021	14/9 13	0³⁰ a.m.	37°54′	46°47′	23°89	23°66	22°41	19°85	S 200	65	240	..	..	2	..	..
»	»	»	..	..	..	..	..	..	S 150	80	240	..	..	1	..	..
1027	27/9 13	0¹⁵ a.m.	39°56′	52°17′	22°46	..	..	21°36	S 200	80	240	..	..	1	1	..
1031	3/10 13	8⁰⁰ p.m.	33°18′	56°03′	25°0	..	..	..	S 200	80	240	..	1	..	..	..
»	»	»	..	..	..	..	..	..	S 200	150	240	..	2	2	..	..
1032	6/10 13	8¹⁰ p.m.	31°39′	53°23′	25°7	..	..	..	S 200	65	240	..	1	5	..	..
»	»	»	..	..	..	..	..	..	S 150	150	240	..	..	..	1	..
»	»	»	..	..	..	..	..	..	PS 150	600	240	..	1	..	2	..
1033	8/10 13	0¹⁰ a.m.	29°52′	53°30′	25°7	..	..	..	S 200	65	240	..	..	1	2	..
»	»	»	..	..	..	..	..	..	S 200	85	240	..	1	6	5	..
1034	9/10 13	0¹⁰ a.m.	28°21′	52°40′	26°00	26°16	21°91	20°67	S 200	65	240	..	..	1	..	..
»	»	»	..	..	..	..	..	..	S 200	85	240	..	3	17	6	..
1037	13/10 13	8⁰⁰ p.m.	24°45′	51°35′	26°6	..	..	..	S 200	65	240	..	..	4	..	..
»	»	»	..	..	..	..	..	..	S 200	80	240	..	..	7	1	..
1038	14/10 13	8⁰⁰ p.m.	25°26′	51°34′	26°2	..	..	..	S 150	65	240	..	..	..	1	..
»	»	»	..	..	..	..	..	..	S 200	80	240	..	..	1	..	..
1039	18/10 13	8⁰⁰ p.m.	26°46′	54°02′	26°1	..	..	..	S 200	80	240	..	..	5	..	..
»	»	»	..	..	..	..	..	..	S 200	110	240	3	52	70	4	..
1040	21/10 13	0¹⁵ a.m.	28°06′	55°16′	..	..	..	..	S 200	80	240	..	..	1	1	..
»	20/10 13	7⁵⁰ p.m.	..	..	25°9	..	..	..	S 200	110	240	..	2	23	..	..
1041	22/10 13	7⁵⁰ p.m.	29°43′	57°28′	25°0	..	..	..	S 150	80	240	..	..	2	..	..
»	»	»	..	..	..	..	..	..	S 150	110	240	..	..	2	..	..
»	»	»	..	..	..	..	..	..	S 200	150	240	..	1	1	1	..
1042	23/10 13	7⁵⁰ p.m.	30°55′	58°48′	25°1	..	..	..	S 150	65	240	..	..	3	..	..
»	»	»	..	..	..	..	..	..	S 200	80	240	..	18	39	3	..
1043	21/10 13	8⁰⁰ p.m.	31°59′	59°52′	24°9	..	..	..	S 150	25	240	..	..	1	..	..
»	»	»	..	..	..	..	..	..	PS 150	110	240	..	..	1	1	..
»	»	»	..	..	..	..	..	..	S 200	150	240	..	2	..	3	..
1044	26/10 13	8⁰⁰ p.m.	32°14′	63°51′	24°7	..	..	..	PS 150	110	240	..	2	5	4	..
1045	27/10 13	7⁵⁰ p.m.	32°21′	64°15′	25°0	..	..	..	S 150	65	240	..	1	8	1	..
»	»	»	..	..	..	..	..	..	S 200	80	240	2	37	49	19	..
1053	10/11 13	0²⁰ a.m.	32°03′	62°01′	23°58	23°37	21°94	20°37	S 200	65	240	..	3	4	4	..
»	»	»	..	..	..	..	..	..	S 200	80	240	..	5	6	2	..
»	»	»	..	..	..	..	..	..	S 150	110	240	..	..	..	..	1
1054	12/11 13	0²⁰ a.m.	31°58′	58°04′	23°86	23°71	21°68	19°86	S 200	65	240	..	..	1	..	..
1055	15/11 13	7⁵⁰ p.m.	31°40′	55°49′	24°4	..	..	..	S 200	80	240	..	..	1	..	..
1056	17/11 13	7⁵⁰ p.m.	30°53′	52°47′	24°2	..	..	..	S 200	65	240	..	..	6	..	..
»	»	»	..	..	..	..	..	..	S 200	80	240	..	..	6	..	..
»	»	»	..	..	..	..	..	..	PS 150	110	240	..	1	10	..	..
1057	22/11 13	0²⁰ a.m.	30°23′	48°17′	23°14	23°27	20°11	18°98	S 200	80	240	..	..	2	..	..

Station No.	Date	Hour	Position		Temperature				Gear	Wire out Meters	Duration of haul in minutes	Sizes (mm)				
			Lat.	Long.	Surface	50 m.	75 m.	100 m.				<10	10-15	15-25	25-40	>40
			N.	W.												
1058	24/11 13	8[00] p.m.	29°24′	48°08′	23°4	..	..	..	S 150	65	240	..	..	1	..	..
»	»	»	..	..	..	..	..	..	S 150	80	240	..	..	2	..	..
1059	26/11 13	7[50] p.m.	28°22′	46°20′	23°6	..	..	..	S 200	80	240	..	..	13	1	..
1060	28/11 13	7[50] p.m.	25°34′	46°06′	24°10	24°20	24°10	21°26	PS 150	10	240	..	..	4	..	..
»	29/11 13	1[00] a.m.	..	..	..	..	..	..	PS 150	10	240	..	..	4	..	..
»	28/11 13	7[50] p.m.	..	..	..	..	..	..	S 150	65	240	..	..	1	..	..
»	»	»	..	..	..	..	..	..	S 150	80	240	..	..	1	..	..
»	»	»	..	..	..	..	..	..	S 200	110	240	..	..	3	2	..
»	29/11 13	1[00] a.m.	..	..	..	..	..	..	S 150	150	240	1	..	1	..	..
»	»	»	..	..	..	..	..	..	S 200	300	240	..	..	1	..	..
1061	30/11 13	0[20] a.m.	24°46′	46°06′	24°47	24°58	23°17	21°06	S 150	25	240	..	..	..	1	..
»	»	»	..	..	..	..	..	..	S 200	80	240	..	..	2	..	..
»	»	»	..	..	..	..	..	..	S 200	150	240	..	5	1	..	..
1063	3/12 13	0[20] a.m.	21°47′	47°11′	25°02	25°17	23°84	22°30	S 200	65	240	..	..	2	1	..
»	»	»	..	..	..	..	..	..	S 200	110	240	..	5	6	2	..
1064	4/12 13	7[50] p.m.	23°00′	49°57′	25°0	..	..	..	S 200	110	240	..	2	6	..	..
1065	6/12 13	12[00] p.m.	23°36′	51°17′	24°76	24°80	23°17	22°06	S 200	65	240	..	2	3	..	..
»	»	»	..	..	..	..	..	..	S 200	110	240	..	10	11	2	..
1066	8/12 13	12[00] p.m.	24°43′	52°18′	24°87	25°16	23°91	22°63	S 200	65	240	..	2	1	2	..
»	»	»	..	..	..	..	..	..	P 150	80	240	..	..	2	..	..
»	»	»	..	..	..	..	..	..	S 200	110	240	..	8	20	..	..
1067	9/12 13	0[00] a.m.	25°35′	53°13′	24°38	24°46	22°60	21°78	S 200	110	240	..	2	..	..	..
1068	11/12 13	8[00] p.m.	25°32′	54°41′	24°9	..	..	..	S 200	65	240	..	..	3	..	..
»	»	»	..	..	..	..	..	..	S 200	110	240	..	..	1	..	..
»	»	»	..	..	..	..	..	..	P 150	150	240	1	5	1	..	..
1070	15/12 13	8[00] p.m.	23°58′	57°15′	24°86	24°89	23°92	21°46	S 200	65	240	..	1	1	..	..
»	»	»	..	..	..	..	..	..	S 200	110	240	..	4	6	..	..
»	»	»	..	..	..	..	..	..	P 150	150	240	..	3	3	1	..
1071	17/12 13	0[00] a.m.	22°13′	58°36′	25°60	27°10	25°10	23°29	P 150	150	240	..	2	12	1	..
1073	20/12 13	8[00] p.m.	19°32′	63°01′	..	..	..	..	S 200	110	240	..	12	..	..	..
830	15/4 20	2[00] a.m.	24°44′	22°32′	19°5	19°3	..	18°9	S 200	100	120	..	..	1	2	..
»	»	»	..	..	..	..	..	..	S 200	300	120	..	..	..	..	1
831	17/4 20	3[00] a.m.	24°34′	28°04′	20°0	19°95	..	19°7	P 150	50	120	..	..	1	..	..
»	»	»	..	..	..	..	..	..	P 150	100	120	..	..	1	2	1
832	19/4 20	2[00] a.m.	24°10′	33°11′	20°4	20°3	..	20°1	S 200	50	180	..	..	1	..	..
»	»	»	..	..	..	..	..	..	S 200	100	180	..	..	..	2	1
»	»	»	..	..	..	..	..	..	S 200	300	180	..	..	..	2	1
834	20/4 20	3[00] a.m.	24°20′	35°31′	21°0	20°9	..	20°3	P 150	50	120	..	..	3	4	..
»	»	»	..	..	..	..	..	..	P 150	100	120	..	..	6	2	..
»	»	»	..	..	..	..	..	..	P 150	300	120	..	1	..	..	..
835	20/4 20	8[10] p.m.	24°44′	36°58′	..	..	..	..	P 150	100	45	..	1	7	1	..
836	22/4 20	3[00] a.m.	24°29′	40°02′	22°0	21°6	..	20°95	P 150	90	120	..	..	9	2	..
»	»	»	..	..	..	..	..	..	S 200	100	120	..	..	9	2	..
837	24/4 20	3[00] a.m.	23°40′	43°26′	22°5	22°15	..	21°6	P 150	50	120	..	..	1	..	..
»	»	»	..	..	..	..	..	..	P 150	100	120	..	..	2	..	..
»	»	»	..	..	..	..	..	..	P 150	300	120	..	1	..	..	..
838	25/4 20	4[00] a.m.	24°31′	44°38′	22°0	..	..	..	P 150	100	60	..	..	2	..	..
839	26/4 20	3[00] a.m.	24°31′	46°46′	22°8	..	..	..	P 150	100	120	..	..	6	2	..
840	27/4 20	4[00] a.m.	25°29′	48°03′	23°0	..	..	..	P 150	100	60	..	..	2	1	..
842	28/4 20	3[00] a.m.	25°48′	49°22′	23°2	..	..	..	P 150	100	120	..	7	5	..	..
841	29/4 20	3[00] a.m.	25°49′	51°55′	23°8	23°4	..	22°5	P 150	100	120	..	3	1	..	..
»	»	»	..	..	..	..	..	..	P 150	150	120	..	1	5	1	..
»	»	»	..	..	..	..	..	..	P 150	200	120	5	16	8	..	1
»	»	»	..	..	..	..	..	..	P 150	300	120	..	1	1	2	..
845	30/4 20	3[00] a.m.	24°46′	54°08′	24°0	..	..	..	P 150	100	120	..	1	3	..	..
»	»	»	..	..	..	..	..	..	P 150	150	120	..	6	8	..	..

Station No.	Date	Hour	Position		Temperature				Gear	Wire out Meters	Duration of haul in minutes	Sizes (mm)				
			Lat.	Long.	Surface	50 m.	75 m	100 m.				<10	10-15	15-25	25-40	>40
			N.	W.												
845	30/4 20	3^00 a.m.	24°46′	54°08′	24°0	..	..	..	P 150	200	120	..	15	7	1	..
»	»	»	..	..	..	..	..	..	P 150	300	120	..	..	4	..	..
846	1/5 20	4^00 a.m.	23°40′	55°22′	25°0	..	..	..	P 150	100	60	..	3	3	..	..
»	»	»	..	..	..	..	..	..	P 150	150	60	..	7	6	..	..
847	2/5 20	4^00 a.m.	22°34′	57°07′	25°2	..	..	..	P 150	200	60	..	4	7	..	..
849	3/6 20	3^00 a.m.	19°00′	63°53′	27°0	26°0	..	24°6	P 150	100	120	..	1	3	..	..
»	»	»	..	..	..	..	..	..	P 150	200	120	3	5	18	..	..
»	»	»	..	..	..	..	..	..	S 200	300	120	..	..	1	1	..
850	4/6 20	3^00 a.m.	20°39′	61°48′	27°0	25°65	..	23°8	P 150	100	120	..	4	2	..	..
»	»	»	..	..	..	..	..	..	S 200	150	120	18	12	10	..	..
»	»	»	..	..	..	..	..	..	P 150	200	120	10	1	22	2	..
»	»	»	..	..	..	..	..	..	S 200	300	120	1	..	3	..	..
851	5/6 20	3^00 a.m.	22°23′	60°46′	27°0	..	..	..	P 150	100	120	..	1	..	..	..
»	»	»	..	..	..	..	..	..	P 150	150	120	..	6	3	..	..
»	»	»	..	..	..	..	..	..	P 150	200	120	..	4	4	2	..
852	6/6 20	3^00 a.m.	24°06′	60°00′	27°0	..	..	..	P 150	100	120	..	1	1	2	..
»	»	»	..	..	..	..	..	..	P 150	150	120	1	8	..	..	..
»	»	»	..	..	..	..	..	..	P 150	200	120	13	17	6	1	..
853	7/6 20	2^00 a.m.	25°52′	59°25′	26°0	25°3	..	22°1	P 150	100	120	..	4	4	..	..
»	»	»	..	..	..	..	..	..	P 150	200	120	2	8	21	..	..
854	8/6 20	2^00 a.m.	27°53′	59°23′	24°0	..	..	..	S 200	150	120	..	3	36	4	..
855	8/6 20	8^00 p.m.	29°15′	59°45′	..	..	..	..	S 200	100	180	..	..	10	6	..
»	»	»	..	..	..	..	..	..	S 200	150	180	..	..	..	..	1
»	»	»	..	..	..	..	..	..	S 200	200	180	..	..	1	3	1
»	9/6 20	0^20 a.m.	..	..	..	..	..	..	P 150	50	180	..	6	12	2	..
»	»	»	..	..	..	..	..	..	P 150	100	180	..	..	1	..	..
»	»	»	..	..	..	..	..	..	P 150	150	180	..	4	20	..	..
»	»	»	..	..	..	..	..	..	P 150	200	180	..	..	2	2	..
»	»	»	..	..	..	..	..	..	S 200	500	180	..	..	4	..	..
»	9/6 20	3^00 a.m.	..	..	..	..	..	..	S 200	100	60	..	4	4	..	..
»	»	»	..	..	..	..	..	..	S 200	150	60	1	..	6	..	..
»	»	»	..	..	..	..	..	..	S 200	200	60	..	2	3	..	..
»	9/6 20	8^00 p.m.	..	..	..	..	..	..	S 200	150	120	9	8	9	6	..
»	»	»	..	..	..	..	..	..	S 200	100	120	..	1	11	9	..
»	»	»	..	..	..	..	..	..	S 200	50	120	..	..	1	..	..
»	9/6 20	11^00 p.m.	..	..	..	..	..	..	S 200	150	120	..	3	1	..	..
»	»	»	..	..	..	..	..	..	S 200	100	120	..	3	33	3	..
»	»	»	..	..	..	..	..	..	S 200	50	120	..	..	..	1	..
»	10/6 20	2^00 a.m.	..	..	..	..	..	..	S 200	150	120	..	15	68	4	..
»	»	»	..	..	..	..	..	..	S 200	100	120	..	..	3	..	..
856	11/6 20	8^00 p.m.	30°47′	60°33′	23°0	..	..	..	S 200	25	120	..	..	8	6	..
»	»	»	..	..	..	..	..	..	S 200	50	120	..	..	6	8	..
»	»	»	..	..	..	..	..	..	S 200	100	120	..	1	4	5	..
»	»	»	..	..	..	..	..	..	S 200	150	120	..	..	3	..	..
857	13/6 20	1^30 a.m.	30°47′	62°27′	23°0	..	..	..	P 150	25	120	..	1	..	..	..
»	»	»	..	..	..	..	..	..	S 200	50	120	..	7	44	4	..
»	»	»	..	..	..	..	..	..	S 200	100	120	..	2	2	1	..
»	»	»	..	..	..	..	..	..	S 200	150	120	..	..	..	1	..
858	14/6 20	1^00 a.m.	29°31′	64°00′	23°0	..	..	..	P 150	25	120	..	..	5	2	..
»	»	»	..	..	..	..	..	..	S 200	50	120	..	1	12	20	..
»	»	»	..	..	..	..	..	..	S 200	100	120	..	..	2	1	..
»	»	»	..	..	..	..	..	..	S 200	150	120	4	..	..	1	..
»	»	»	..	..	..	..	..	..	S 200	200	120	..	..	1	..	..
859	15/6 20	1^00 a.m.	29°02′	65°09′	..	..	..	..	S 200	100	120	..	2	3	..	..
»	»	»	..	..	..	..	..	..	S 200	150	120	..	3	4	5	..
»	»	»	..	..	..	..	..	..	S 200	200	120	8	5	12	4	1

Station No.	Date	Hour	Position		Temperature				Gear	Wire out Meters	Duration of haul in minutes	Sizes (mm)				
			Lat.	Long.	Surface	50 m.	75 m.	100 m.				<10	10—15	15—25	25—40	>40
			N.	W.												
861	19/6 20	1.30 a.m.	32°30′	64°24′	23°5	..	..	..	P 150	100	120	..	..	..	..	1
862	20/6 20	1.15 a.m.	31°36′	62°25′	23°5	..	..	..	P 150	50	120	..	..	..	3	..
»	»	»	..	..	..	..	..	..	S 200	150	120	..	..	2	5	6
863	21/6 20	1.15 a.m.	30°43′	60°46′	24°5	..	..	..	S 200	50	120	..	..	5	5	..
»	»	»	..	..	..	..	..	..	P 150	100	120	..	1	..	1	..
»	»	»	..	..	..	..	..	..	S 200	150	120	..	4	13	3	1
864	22/6 20	1.15 a.m.	30°02′	59°10′	..	..	..	..	S 200	50	120	..	..	6	6	1
»	»	»	..	..	..	..	..	..	P 150	100	120	..	4	18	5	..
»	»	»	..	..	..	..	..	..	S 200	150	120	..	2	6	7	1
865	23/6 20	1.30 a.m.	29°19′	57°43′	25°0	..	..	..	P 150	100	120	..	2	..	1	..
»	»	»	..	..	..	..	..	..	S 200	150	120	..	..	..	..	1
»	»	»	..	..	..	..	..	..	P 150	200	120	..	3	..	..	..
866	23/6 20	8.30 p.m.	28°32′	56°38′	25°0	..	..	..	P 150	200	120	42	13	7	2	..
867	24/6 20	3.00 a.m.	28°15′	56°29′	25°0	..	..	..	P 150	100	60	..	3	4	3	..
»	»	»	..	..	..	..	..	..	S 200	150	60	1	..	4	2	..
868	24/6 20	8.40 p.m.	27°10′	55°52′	25°0	..	..	..	P 150	100	60	..	..	2	..	..
»	»	»	..	..	..	..	..	..	P 150	150	60	..	2	..	..	..
870	26/6 20	8.00 p.m.	27°29′	59°20′	25°0	..	..	..	S 150	150	120	..	..	1	..	..
»	»	11.00 p.m.	..	..	..	..	..	..	S 150	200	120	2	1	1	..	..
871	28/6 20	1.45 a.m.	27°15′	61°35′	25°0	..	..	..	P 150	200	120	15	9	1	2	..
873	29/6 20	8.10 p.m.	27°04′	65°23′	25°5	..	..	..	S 200	100	120	..	..	2	..	..
»	»	»	..	..	..	..	..	..	S 200	150	120	..	2	2	2	..
874	30/6 20	8.00 p.m.	27°09′	66°09′	25°5	..	..	..	S 200	100	120	..	..	8	1	..
»	»	»	..	..	..	..	..	..	S 200	150	120	..	1	4	..	..
875	1/7 20	8.00 p.m.	28°58′	67°09′	25°0	..	..	..	S 150	150	60	..	1	5	..	..
876	2/7 20	8.10 p.m.	30°58′	66°14′	24°5	..	..	..	S 150	150	60	..	..	1	1	..
878	9/7 20	11.10 p.m.	33°24′	61°05′	25°0	..	..	..	S 200	100	120	..	..	..	..	1
879	10/7 20	11.00 p.m.	33°46′	58°56′	25°0	..	..	..	S 200	100	120	..	..	4	4	..
»	»	»	..	..	..	..	..	..	P 150	150	120	..	..	1	4	1
881	13/7 20	1.30 a.m.	34°42′	54°00′	25°0	..	..	..	S 200	100	120	..	1	1	3	..
»	»	»	..	..	..	..	..	..	P 150	150	120	..	4	2	1	..
883	14/7 20	11.15 p.m.	30°53′	54°07′	25°0	..	..	..	S 200	100	120	..	..	..	3	1
884	15/7 20	11.30 p.m.	28°49′	54°10′	25°0	..	..	..	S 200	100	120	..	6	5	3	..
»	»	»	..	..	..	..	..	..	P 150	150	120	5	2	3	6	..
885	16/7 20	11.15 p.m.	26°46′	54°14′	24°5	..	..	..	S 200	100	120	..	5	5	1	..
»	»	»	..	..	..	..	..	..	P 150	150	120	..	12	25	9	..
886	17/7 20	11.30 p.m.	24°40′	54°19′	25°5	..	..	..	S 200	50	120	..	..	2	..	..
»	»	»	..	..	..	..	..	..	S 200	100	120	..	..	6	2	..
»	»	»	..	..	..	..	..	..	P 150	150	120	1	4	7	3	..
887	19/7 20	8.30 p.m.	26°19′	58°58′	26°0	..	..	..	S 150	100	120	..	..	3	1	..
»	»	»	..	..	..	..	..	..	P 150	150	120	1	6	27	13	..
888	20/7 20	8.30 p.m.	27°31′	61°32′	26°0	..	..	..	S 200	100	120	..	2	7	2	..
»	»	»	..	..	..	..	..	..	P 150	150	120	10	10	13	2	..
889	21/7 20	8.30 p.m.	28°20′	63°50′	26°0	..	..	..	S 200	100	120	..	..	..	2	..
»	»	»	..	..	..	..	..	..	P 150	150	120	6	5	10	3	..
890	22/7 20	8.30 p.m.	28°44′	66°04′	27°0	..	..	..	S 200	100	120	..	1	..	..	..
»	»	»	..	..	..	..	..	..	P 150	150	120	11	8	9	..	..
»	»	»	..	..	..	..	..	..	P 150	200	120	..	..	1	..	..
891	24/7 20	2.00 a.m.	29°28′	69°25′	27°0	..	..	..	S 150	50	120	..	..	1	1	..
»	»	»	..	..	..	..	..	..	S 200	100	120	..	..	13	14	..
»	»	»	..	..	..	..	..	..	P 150	150	120	17	4	6	..	..
»	»	»	..	..	..	..	..	..	P 150	200	120	8	5	..	..	..
895	13/8 20	8.30 p.m.	39°20′	65°55′	24°0	..	..	..	S 200	100	120	..	..	..	1	..
897	16/8 20	8.30 p.m.	40°07′	51°02′	24°0	..	..	..	S 200	100	120	..	..	1	..	1
»	»	»	..	..	..	..	..	..	S 150	150	120	..	..	..	..	1

Station No.	Date	Hour	Position Lat.	Position Long.	Temperature Surface	Temperature 50 m.	Temperature 75 m.	Temperature 100 m.	Gear	Wire out Meters	Duration of haul in minutes	Sizes (mm) <10	10—15	15—25	25—40	>40
			N.	W.												
901	22/2 21	8⁰⁰ p.m.	17°55′	64°48′	..	..	..	..	P 150	100	120	..	4	6	..	..
»	»	»	..	..	..	..	..	..	S 200	150	120	..	..	2	..	..
»	»	3³⁰ p.m.	..	..	27°0	..	..	..	P 150	200	120	..	..	1	..	..
902	25/2 21	8⁰⁰ p.m.	19°34′	64°06′	25°0	..	..	..	S 200	150	120	..	..	1	..	..
903	26/2 21	10³⁰ p.m.	21°13′	63°04′	25°0	..	..	..	S 150	50	120	..	..	2	..	..
»	»	»	..	..	..	..	..	..	P 150	100	120	..	3	..	..	..
»	»	»	..	..	..	..	..	..	S 200	150	120	..	..	2	..	..
904	27/2 21	8⁰⁰ p.m.	22°31′	62°07′	25°0	..	..	..	S 150	100	120	..	7	2	..	..
»	»	»	..	..	..	..	..	..	S 150	150	120	..	1	2	..	..
»	»	»	..	..	..	..	..	..	S 200	200	120	..	1	4	..	..
906	2/3 21	8⁰⁰ p.m.	25°50′	61°09′	24°0	..	..	..	S 200	150	120	..	..	6	..	..
907	3/3 21	8⁰⁰ p.m.	27°24′	60°09′	23°5	..	..	..	S 150	150	120	..	1	1	..	..
»	»	»	..	..	..	..	..	..	S 200	200	120	..	6	6	1	..
908	4/3 21	8⁰⁰ p.m.	28°20′	59°16′	23°5	..	..	..	S 150	100	120	..	1	1	..	..
»	»	»	..	..	..	..	..	..	S 200	200	120	..	5	16	..	..
909	5/3 21	12⁰⁰ p.m.	29°00′	58°15′	22°5	..	..	..	S 150	50	120	..	4	6	1	..
»	»	9³⁰ p.m.	..	..	..	..	..	..	S 150	100	120	..	2	2	..	..
»	»	»	..	..	..	..	..	..	S 150	200	120	..	5	2	1	..
»	»	7³⁰ p.m.	..	..	..	..	..	..	S 150	300	120	..	1	..	..	..
910	7/3 21	3³⁰ p.m.	27°43′	57°22′	22°5	..	..	..	S 150	200	120	..	3	3	1	..
911	8/3 21	7³⁰ p.m.	26°34′	57°02′	23°5	..	..	..	S 150	100	120	..	..	2	..	..
»	»	»	..	..	..	..	..	..	S 150	200	120	..	..	2	1	..
912	10/3 21	10⁰⁰ p.m.	25°01′	56°21′	23°5	..	..	..	S 150	50	120	..	..	2	..	..
»	»	»	..	..	..	..	..	..	P 150	100	120	..	..	2	..	..
»	»	7³⁰ p.m.	..	..	..	..	..	..	P 150	150	120	..	..	1	..	..
»	»	»	..	..	..	..	..	..	S 150	200	120	..	..	2	1	..
913	12/3 21	8⁰⁰ p.m.	23°37′	55°45′	24°0	..	..	..	S 150	200	120	2	1	2	..	..
914	14/3 21	10³⁰ p.m.	22°31′	54°14′	24°0	..	..	..	S 150	50	120	..	..	1	..	..
»	»	»	..	..	..	..	..	..	P 150	100	120	..	..	1	..	..
»	»	7³⁰ p.m.	..	..	..	..	..	..	P 150	200	120	..	1	7	1	..
916	16/3 21	11⁰⁰ p.m.	25°34′	54°27′	..	..	..	..	S 200	100	120	..	2	1	..	..
»	»	»	..	..	..	..	..	..	S 200	150	120	1	..	5	1	..
»	»	8⁰⁰ p.m.	..	..	23°5	..	..	..	S 200	300	120	2	2	2	1	..
917	17/3 21	8⁰⁰ p.m.	27°24′	53°23′	23°5	..	..	..	S 200	150	120	..	..	1	..	..
»	»	»	..	..	..	..	..	..	S 200	200	120	..	..	3	1	..
»	»	9⁰⁰ a.m.	..	..	..	..	..	..	S 150	300	120	..	..	2	..	..
918	19/3 21	8⁰⁰ p.m.	27°31′	51°10′	23°5	..	..	..	S 200	200	120	..	..	2	..	..
920	22/3 21	10⁴⁵ p.m.	25°01′	52°07′	24°0	..	..	..	S 150	100	120	..	2	4	1	..
»	»	7³⁰ p.m.	..	..	..	..	..	..	P 150	300	120	6	10	3	..	..
921	23/3 21	11⁰⁰ p.m.	24°28′	51°41′	..	..	..	..	S 200	50	120	..	3	1	..	..
»	»	8⁰⁰ p.m.	..	..	24°0	..	..	..	P 150	200	120	..	..	1	..	..
»	»	»	..	..	..	..	..	..	S 200	300	120	..	1	5	..	..
922	24/3 21	11⁰⁰ p.m.	23°56′	50°49′	..	..	..	..	S 200	50	120	..	1	1	..	..
»	»	8⁰⁰ p.m.	..	..	23°5	..	..	..	S 200	300	120	1	5	6	..	..
923	27/3 21	8²⁰ p.m.	22°47′	48°53′	24°0	..	..	..	S 150	200	120	1	6	..	..	..
»	»	»	..	..	..	..	..	..	S 150	300	120	..	..	1	..	..
925	30/3 21	10³⁰ p.m.	21°27′	46°52′	23°5	..	..	..	S 200	50	120	..	2	2	..	..
»	»	7³⁰ p.m.	..	..	..	..	..	..	S 150	100	120	..	1	2	..	..
»	»	10³⁰ p.m.	..	..	..	..	..	..	S 200	150	120	..	1	8	3	..
»	»	7³⁰ p.m.	..	..	..	..	..	..	S 200	200	120	..	4	14	14	..
»	»	»	..	..	..	..	..	..	S 200	300	120	2	..	4	..	..
926	31/3 21	7³⁰ p.m.	21°15′	46°10′	23°5	..	..	..	S 150	100	120	..	..	5	..	..
»	»	»	..	..	..	..	..	..	S 200	200	120	..	..	16	7	..
»	»	»	..	..	..	..	..	..	S 200	300	120	..	..	1	2	..

Station No.	Date	Hour	Position Lat. N.	Position Long. W.	Temperature Surface	50 m.	75 m.	100 m.	Gear	Wire out Meters	Duration of haul in minutes	Sizes (mm) <10	10—15	15—25	25—40	>40
927	2/4 21	2³⁰ a.m.	20°32′	45°02′	..	..	..	..	S 200	50	120	..	1	2	1	..
»	1/4 21	11³⁰ p.m.	..	..	24°0	..	..	..	S 200	200	120	..	1	..	..	..
»	»	»	..	..	..	..	..	..	S 200	300	120	..	..	1	..	..
928	3/4 21	7³⁰ p.m.	22°43′	45°18′	23°5	..	..	..	S 150	100	120	..	2	1	..	..
»	»	10³⁰ p.m.	..	..	..	..	..	..	S 200	150	120	..	3	11	4	..
929	4/4 21	10³⁰ p.m.	24°10′	45°33′	..	..	..	..	S 200	150	120	..	4	4	..	..
»	»	7³⁰ p.m.	..	..	23°5	..	..	..	S 200	200	120	..	5	..	3	..
»	»	»	..	..	..	..	..	..	S 200	300	120	..	..	1	1	..
930	5/4 21	2⁰⁰ p.m.	24°50′	45°46′	23°0	..	..	..	P 150	300	120	..	..	2	..	..
931	6/4 21	10³⁰ p.m.	26°10′	46°32′	..	..	..	..	S 200	50	120	..	..	3	..	..
»	»	»	..	..	..	..	..	..	S 200	150	120	..	3	10	3	..
»	»	7³⁰ p.m.	..	..	22°0	..	..	..	S 200	200	120	..	8	17	..	..
»	»	»	..	..	..	..	..	..	S 200	300	120	..	3	6	2	..
932	7/4 21	7³⁰ p.m.	27°23′	46°24′	21°5	..	..	..	S 150	100	120	..	..	1	1	..
»	»	»	..	..	..	..	..	..	S 200	200	120	..	4	2	5	..
933	10/4 21	10³⁰ p.m.	27°40′	48°40′	..	..	..	..	S 150	200	120	..	..	4	1	..
»	»	7³⁰ p.m.	..	..	21°0	..	..	..	S 150	300	120	4	4	6	..	..
934	11/4 21	10³⁰ p.m.	27°00′	49°50′	..	..	..	..	S 100	10	120	..	..	1	..	..
»	12/4 21	1⁰⁰ a.m.	..	..	..	..	..	..	S 150	100	120	..	3	2	1	..
»	11/4 21	10³⁰ p.m.	..	..	..	..	..	..	S 200	200	120	..	1	1	2	..
»	»	7³⁰ p.m.	..	..	21°0	..	..	..	S 150	300	120	2	..	2	1	..
935	12/4 21	10³⁰ p.m.	24°44′	51°25′	..	..	..	..	S 200	150	120	..	5	7	3	..
»	»	7³⁰ p.m.	..	..	21°5	..	..	..	S 200	200	120	2	8	29	2	..
»	»	»	..	..	..	..	..	..	S 200	300	120	4	6	..	9	..
936	13/4 21	1⁰⁰ p.m.	26°50′	52°08′	22°0	..	..	..	P 150	200	120	..	..	2	..	..
937	15/4 21	3⁰⁰ a.m.	27°04′	53°27′	..	..	..	..	S 200	200	120	1	11	6	..	..
»	»	0³⁰ a.m.	..	..	..	..	..	..	S 200	300	120	4	6	14	2	..
»	14/4 21	9⁴⁵ p.m.	..	..	..	..	..	..	S 200	400	120	..	..	1	1	2
»	»	7⁰⁰ p.m.	..	..	22°0	..	..	..	S 200	500	120	..	1	..	..	..
938	16/4 21	11⁰⁰ a.m.	26°27′	54°38′	22°0	..	..	..	S 150	200	120	3	..	3	..	..
»	»	2³⁰ p.m.	..	..	..	..	..	..	P 150	300	120	15	4	1	..	..
»	»	8⁰⁰ a.m.	..	..	..	..	..	..	S 150	300	120	..	..	2	..	..
»	»	»	..	..	..	..	..	..	S 150	400	120	3	..	..	..	..
»	»	2³⁰ p.m.	..	..	..	..	..	..	P 150	400	120	2	3	..	..	..
»	»	5⁰⁰ p.m.	..	..	..	..	..	..	P 150	500	120	5	2	1	..	..
939	18/4 21	1⁰⁰ a.m.	26°10′	56°30′	..	..	..	..	S 200	200	240	1	6	22	3	..
»	17/4 21	7⁰⁰ p.m.	..	..	..	..	..	..	P 150	300	120	5	5	4	..	..
»	18/4 21	6⁰⁰ p.m.	..	..	22°5	..	..	..	S 150	300	120	2	..	3	..	..
»	17/4 21	7⁰⁰ p.m.	..	..	..	..	..	..	P 150	400	120	..	..	1	..	..
»	18/4 21	6³⁰ p.m.	..	..	..	..	..	..	S 200	100	120	..	..	..	4	..
»	18/4 21	1⁰⁰ p.m.	..	..	..	..	..	..	E 300	500	240	..	..	..	1	1
940	19/4 21	10¹⁵ p.m.	27°20′	57°50′	..	..	..	..	S 200	50	120	..	..	1	..	..
»	»	»	..	..	..	..	..	..	S 200	150	120	..	1	1	..	..
»	»	7⁰⁰ p.m.	..	..	22°5	..	..	..	S 200	300	120	2	..	1	..	..
941	20/4 21	10³⁰ p.m.	27°31′	59°52′	22°5	..	..	..	S 200	100	120	..	..	3	..	..
»	»	»	..	..	..	..	..	..	S 200	200	120	..	1	8	..	..
»	»	7³⁰ p.m.	..	..	..	..	..	..	S 200	300	120	..	2	5	..	..
»	»	»	..	..	..	..	..	..	S 200	400	120	..	5	4	2	1
942	21/4 21	10⁰⁰ p.m.	26°57′	60°58′	23°0	..	..	..	S 200	300	120	..	..	2	..	..
943	22/4 21	9⁰⁰ p.m.	26°20′	62°00′	24°0	..	..	..	S 200	300	120	5	5	8	..	..
944	23/4 21	10³⁰ p.m.	25°40′	63°10′	..	..	..	..	S 200	100	120	..	..	4	..	..
»	»	»	..	..	..	..	..	..	S 200	200	120	..	1	7	..	..
»	»	7³⁰ p.m.	..	..	24°0	..	..	..	S 200	300	120	2	14	25	3	..
»	»	»	..	..	..	..	..	..	S 200	400	120	..	6	9	4	..

Station No.	Date	Hour	Position		Temperature				Gear	Wire out Meters	Duration of haul in minutes	Sizes (mm)				
			Lat.	Long.	Surface	50 m.	75 m.	100 m.				<10	10—15	15—25	25—40	>40
			N.	W.												
945	24/4 21	10³⁰ p.m.	25°00′	64°10′	..	..	..	..	S 200	200	120	..	1	2	..	..
»	»	7³⁰ p.m.	..	..	24°5	..	..	..	S 200	300	120	2	..	1	..	..
946	25/4 21	10³⁰ p.m.	24°20′	65°30′	..	..	..	..	S 200	100	120	..	4	1	..	..
»	»	»	..	..	..	..	..	..	S 200	200	120	1	7	10	1	..
»	»	7³⁰ p.m.	..	..	24°5	..	..	..	S 200	300	120	10	10	1	1	..
947	26/4 21	10³⁰ p.m.	23°10′	66°15′	..	..	..	..	S 200	200	120	1	1	3	1	..
»	»	7³⁰ p.m.	..	..	24°5	..	..	..	S 200	300	120	1	4	2	..	..
»	»	»	..	..	..	..	..	..	S 200	400	120	..	..	..	1	..
»	27/4 21	1⁰⁰ a.m.	..	..	..	..	..	..	E 300	1000	240	..	..	..	..	1
948	27/4 21	10³⁰ p.m.	22°14′	67°22′	..	..	..	..	S 200	200	120	1	3	7	1	..
»	»	7³⁰ p.m.	..	..	25°0	..	..	..	S 200	300	120	1	5	3	1	..
»	»	»	..	..	..	..	..	..	S 200	400	120	..	..	..	2	..
949	28/4 21	10³⁰ p.m.	21°40′	66°55′	..	..	..	..	S 200	100	120	..	1	1	..	..
»	»	»	..	..	..	..	..	..	S 200	200	120	1	1	7	..	..
»	»	7³⁰ p.m.	..	..	25°0	..	..	..	S 200	400	120	..	..	1	..	..
950	29/4 21	10³⁰ p.m.	20°50′	66°30′	..	..	..	..	S 200	100	120	..	..	7	..	..
»	»	»	..	..	..	..	..	..	S 200	200	120	..	1	3	..	..
»	»	7³⁰ p.m.	..	..	25°5	..	..	..	S 200	300	120	4	28	6	1	..
»	»	»	..	..	..	..	..	..	S 200	400	120	..	1	..	1	1
951	1/5 21	1⁰⁰ a.m.	20°20′	65°20′	25°5	..	..	..	S 200	200	120	..	..	4	..	..
»	»	3³⁰ a.m.	..	..	..	..	..	..	S 200	300	120	3	..	2	..	..
»	»	»	..	..	..	..	..	..	S 200	400	120	4	5	10	..	..
952	12/5 21	8⁰⁰ p.m.	17°55′	64°48′	26°5	..	..	..	S 200	50	120	..	..	1	1	..
»	»	11⁰⁰ p.m.	..	..	..	..	..	..	S 200	200	120	..	..	2	..	..
»	»	»	..	..	..	..	..	..	S 200	300	120	..	19	5	..	..
»	13 5 21	2⁰⁰ a.m.	..	..	..	..	..	..	S 200	400	120	..	2	7	2	..
1141	14/10 21	5⁴⁵ p.m.	34°15′	16°53′	21°4	..	..	..	S 200	100	135	..	11	..	..	..
»	»	»	..	..	..	..	..	..	S 200	200	135	10	4	..	..	..
»	15/10 21	3⁰⁰ a.m.	..	..	..	..	..	..	S 200	200	180	43	20	..	..	..
»	»	»	..	..	..	..	..	..	S 200	300	180	5	..	..	..	..
»	»	»	..	..	..	..	..	..	S 200	350	180	12	..	..	..	..
1146	19/10 21	8¹⁰ p.m.	32°00′	19°11′	22°00	..	..	..	S 200	400	120	..	..	2	..	..
1148	20/10 21	8¹⁵ p.m.	32°55′	21°51′	21°90	..	..	..	S 200	500	60	..	..	..	..	1
1151	22/10 21	5⁰⁰ a.m.	30°51′	21°00′	22°40	..	..	..	S 200	200	60	2	..	1	..	..
1153	23/10 21	7²⁰ p.m.	28°48′	20°45′	23°00	..	..	..	S 200	300	90	1	..	4	3	..
»	»	»	..	..	..	..	..	..	S 200	400	90	..	..	1	..	1
»	»	9³⁰ p.m.	..	..	..	..	..	..	S 200	500	60	..	..	..	1	..
1154	24/10 21	5¹⁵ a.m.	27°58′	20°52′	23°00	..	..	..	S 200	300	60	..	..	1	1	..
1155	24 10 21	7¹⁵ p.m.	26°15′	20°53′	23°70	..	..	..	S 200	200	60	..	..	..	1	..
»	»	»	..	..	..	..	..	..	S 200	300	60	..	2	4	3	4
»	»	»	..	..	..	..	..	..	S 200	400	60	..	1	10	4	3
1156	25 10 21	4¹⁰ a.m.	25°11′	20°57′	23°90	22°33	19°73	18°50	S 200	100	60	..	..	1	..	..
»	»	»	..	..	..	..	..	..	S 200	300	60	..	..	5	4	..
»	»	»	..	..	..	..	..	..	S 200	800	60	..	..	1	..	..
1157	27 10 21	2³⁰ a.m.	21°57′	22°58′	24°64	22°15	20°18	18°95	S 200	300	120	..	..	2	1	..
»	»	10⁰⁰ p.m.	..	..	..	..	..	..	S 200	500	120	..	..	..	..	1
»	»	»	..	..	..	..	..	..	S 200	600	120	..	..	..	1	..
»	»	»	..	..	..	..	..	..	S 200	800	120	..	..	..	2	..
»	»	4³⁰ p.m.	..	..	..	..	..	..	S 150	1000	180	..	..	2	..	..
»	»	»	..	..	..	..	..	..	S 150	2000	180	..	..	..	..	1
1159	29/10 21	10⁴⁵ p.m.	17°55′	24°35′	25°40	25°39	21°49	18°17	S 200	100	120	..	..	2	3	..
»	»	»	..	..	..	..	..	..	S 200	300	120	..	..	..	2	1
»	»	»	..	..	..	..	..	..	S 200	600	120	..	..	..	..	1
»	»	4⁵⁰ p.m.	..	..	..	..	..	..	S 150	3000	180	..	..	..	..	2
1160	4/11 21	3⁰⁰ a.m.	15°50′	26°32′	26°51	21°83	19°77	18°49	S 200	100	120	..	1	1	..	..

Station No.	Date	Hour	Position Lat. N.	Position Long. W.	Temperature Surface	Temperature 50 m.	Temperature 75 m.	Temperature 100 m.	Gear	Wire out Meters	Duration of haul in minutes	Sizes (mm) <10	Sizes (mm) 10—15	Sizes (mm) 15—25	Sizes (mm) 25—40	Sizes (mm) >40
1160	4/11 21	3[00] a.m.	15°50′	26°32′	..	..	..	..	S 200	300	120	..	..	..	..	1
1161	5/11 21	3[45] a.m.	14°52′	28°04′	26°10	..	..	..	S 200	100	120	..	32	66	25	2
1162	6/11 21	10[00] p.m.	13°35′	30°11′	26°77	19°77	16°82	13°69	S 200	300	120	..	..	..	1	1
1163	7/11 21	8[00] p.m.	12°59′	32°49′	27°00	..	..	..	S 200	300	120	..	..	..	..	1
»	»	»	..	..	..	..	..	..	S 200	600	120	..	..	1	1	..
1165	9/11 21	4[00] a.m.	12°11′	35°49′	..	24°46	18°30	13°89	S 150	300	120	..	..	1	2	..
»	»	8[00] a.m.	..	..	..	..	..	..	S 150	4000	180	..	..	..	..	1
1166	11/11 21	4[00] a.m.	10°16′	40°41′	27°37	22°88	16°76	14°24	S 200	100	120	..	1	4	..	..
»	»	»	..	..	..	..	..	..	S 200	300	120	..	..	..	1	..
»	»	»	..	..	..	..	..	..	S 200	600	120	..	..	2	..	..
1171	13/11 21	4[00] a.m.	8°19′	44°35′	28°87	24°76	20°97	15°84	S 200	100	120	..	..	1	3	..
»	»	8[00] a.m.	..	..	..	..	..	..	S 150	4000	180	..	..	..	1	..
1173	15/11 21	7[10] p.m.	6°18′	48°58′	27°53	27°16	25°36	22°02	S 200	300	60	..	..	..	..	1
1178	19/11 21	6[50] p.m.	10°24′	54°38′	27°60	26°50	24°62	21°85	S 200	100	120	..	..	2	1	..
»	»	»	..	..	..	..	..	..	S 200	300	120	..	2	9	12	2
»	»	»	..	..	..	..	..	..	S 200	600	120	..	2	2	1	..
1180	20/11 21	9[30] p.m.	12°11′	57°12′	..	..	..	..	S 200	300	120	4	16	20	5	1
»	»	»	..	..	..	..	..	..	S 200	600	120	..	1	..	..	..
1182	23/11 21	10[20] p.m.	13°03′	59°50′	27°53	27°46	25°36	24°40	S 200	300	120	..	..	7	2	..
1183	24/11 21	4[30] p.m.	13°47′	61°26′	27°79	27°25	24°94	22°51	S 150	500	180	..	..	..	4	1
»	»	10[45] p.m.	..	..	..	..	..	..	S 200	600	120	..	..	..	1	1
1184	25/11 21	10[15] p.m.	15°08′	61°31′	27°20	..	..	..	S 200	100	120	..	1	..	..	..
»	»	»	..	..	..	..	..	..	S 200	300	120	..	3	3	1	..
»	»	»	..	..	..	..	..	..	S 200	600	120	..	..	3	2	..
»	»	»	..	..	..	..	..	..	S 200	800	120	..	1	..	..	..
1185	27/11 21	1[30] a.m.	17°41′	60°58′	27°70	26°80	26°85	24°91	S 200	100	60	..	5	3	..	..
»	»	»	..	..	..	..	..	..	S 200	600	60	..	..	1	..	..
»	»	4[15] a.m.	..	..	..	..	..	..	S 200	1200	60	..	1	1	..	..
1186	1/12 21	0[45] a.m.	17°58.5′	64°41′	27°05	27°60	26°24	24°73	S 200	100	180	..	1	..	..	..
»	»	»	..	..	..	..	..	..	S 200	300	180	..	1	..	..	..
»	30/11 21	6[15] p.m.	17°54′	64°54′	..	..	..	..	S 150	1000	240	..	..	..	1	..
1189	8/12 21	11[55] p.m.	17°58.5′	64°41′	27°09	27°08	26°30	24°74	S 200	100	300	..	1	1	..	..
»	»	2[40] p.m.	..	..	..	..	..	..	S 150	2000	300	..	..	..	..	1
»	»	11[55] p.m.	..	..	..	..	..	..	S 200	300	300	..	..	..	2	..
1190	13/12 21	4[00] a.m.	17°58.5′	64°45′	..	..	..	..	S 200	100	120	..	1	4	..	..
»	12/12 21	6[45] p.m.	..	..	..	..	..	..	S 200	300	120	..	4	..	..	..
»	»	»	..	..	..	..	..	..	S 200	1000	120	..	1	..	..	..
1191	15/12 21	4[00] a.m.	17°49′	64°54′	26°80	..	..	..	S 200	100	90	..	1	..	..	..
»	14/12 21	6[50] p.m.	..	..	..	..	..	..	S 200	300	90	3	11	4	..	..
»	15/12 21	4[00] a.m.	..	..	..	..	..	..	S 200	300	90	..	2	6	..	..
»	14/12 21	6[50] p.m.	..	..	..	..	..	..	S 200	600	90	..	1	..	..	..
»	15/12 21	4[00] a.m.	..	..	..	..	..	..	S 200	600	90	..	..	1	..	..
1192	16/12 21	2[30] a.m.	17°43.4′	64°54.3′	26°80	..	..	..	S 200	300	120	1	3	2	..	..
»	»	»	..	..	..	..	..	..	S 200	600	120	..	..	1	..	..
1194	21/12 21	11[50] p.m.	17°58.5′	64°41′	..	..	..	..	S 200	50	120	..	..	1	..	..
»	»	9[45] p.m.	..	..	26°50	..	..	..	S 150x	300	90	..	5	2	..	..
»	22/12 21	2[50] a.m.	..	..	..	..	..	..	S 100x	300	90	..	2	1	..	..
»	21/12 21	9[45] p.m.	..	..	..	..	..	..	S 150	306	90	..	4	..	..	..
»	»	»	..	..	..	..	..	..	S 150	312	90	..	2	2	..	..
»	»	»	..	..	..	..	..	..	S 200	320	90	..	2	3	..	..
1195	3/1 22	0[50] a.m.	19°01′	65°23′	26°03	26°73	25°75	24°15, 26°10	S 200	300	120	..	..	2	3	..
1202	10/1 22	4[50] a.m.	9°40′	79°56′	26°44	26°76	26°10	24°51	S 200	100	120	..	3	3	1	..
»	»	2[05] a.m.	..	..	..	..	..	..	S 200	300	120	..	1	..	1	..
»	»	»	..	..	..	..	..	..	S 200	600	120	..	..	1	..	..

Station No.	Date	Hour	Position Lat.	Position Long.	Temperature Surface	Temperature 50 m.	Temperature 75 m.	Temperature 100 m.	Gear	Wire out Meters	Duration of haul in minutes	Sizes (mm) <10	10—15	15—25	25—40	>40
			N.	W.												
1214	26/1 22	2[00] a.m.	14°21′	76°50′	26°41	26°17	26°05	24°82	S 150	50	120	..	..	2	1	..
»	»	»	..	..	..	..	..	..	S 150	100	120	..	..	2	2	..
»	»	10[45] p.m.	..	..	..	..	..	..	S 150	300	120	4	..	..	..	..
»	»	»	..	..	..	..	..	..	S 150	600	120	..	..	..	1	..
1215	27/1 22	10[45] p.m.	16°06′	76°02′	..	..	..	..	S 150	50	120	..	..	1	1	..
»	»	»	..	..	..	..	..	..	S 150	100	120	..	3	6	2	..
»	»	7[30] p.m.	..	..	26°10	..	..	..	S 150	300	120	..	..	..	1	..
»	»	»	..	..	..	..	..	..	S 150	1000	120	..	2	1	..	..
1216	28/1 22	9[45] p.m.	18°22′	78°38′	26°20	..	..	..	S 200	50	120	..	..	5	..	..
»	»	»	..	..	..	..	..	..	S 200	100	120	..	7	4	1	..
1218	30/1 22	6[50] p.m.	20°08′	82°59′	26°00	..	..	..	S 200	50	60	..	..	7	..	..
»	»	»	..	..	..	..	..	..	S 200	300	60	..	..	..	1	..
1223	1/2 22	7[40] p.m.	22°06′	84°58′	..	..	..	..	S 200	50	120	..	3	1	..	..
»	»	»	..	..	..	..	..	..	S 200	100	120	..	4	4	2	..
»	»	10[45] p.m.	..	..	25°80	..	..	..	S 200	300	120	..	3	2	2	..
»	»	»	..	..	..	..	..	..	S 200	500	120	..	..	1	1	..
1225	2/2 22	9[40] p.m.	23°58′	83°22′	24°81	24°76	24°76	24°73	S 200	50	120	..	..	5	..	..
»	»	»	..	..	..	..	..	..	S 200	100	120	..	12	4	..	..
»	»	»	..	..	..	..	..	..	S 200	300	120	..	..	..	4	..
1229	4/2 22	3[30] a.m.	23°13′	82°21′	25°10	25°23	25°26	25°20	S 200	100	120	..	3	1	1	..
1230	5/2 22	10[30] p.m.	23°13′	82°21′	..	..	..	..	S 200	600	120	..	..	..	3	..
»	»	7[00] p.m.	..	..	..	..	..	..	S 200	800	120	..	..	..	1	..
1231	6/2 22	8[15] p.m.	24°30′	80°00′	25°39	25°24	25°24	25°17	S 200	50	120	..	..	..	1	..
»	»	»	..	..	..	..	..	..	S 200	300	120	..	..	..	1	..
1238	11/2 22	4[00] a.m.	26°13′	78°48′	23°50	23°52	23°52	23°52	S 200	50	120	..	..	1	..	..
»	»	»	..	..	..	..	..	..	S 200	300	120	..	..	..	2	..
1239	12/2 22	2[15] a.m.	25°50′	76°55′	23°42	23°35	23°22	23°17	S 200	100	120	..	4	..	..	..
»	»	»	..	..	..	..	..	..	S 200	300	120	2	1	4	..	..
»	»	»	..	..	..	..	..	..	S 150	500	120	2	1	2	..	..
»	»	»	..	..	..	..	..	..	S 200	600	120	..	3	..	1	..
»	11/2 22	8[15] p.m.	..	..	..	..	..	..	S 200	800	120	..	1	2	..	..
»	»	»	..	..	..	..	..	..	S 200	1000	120	..	..	1	..	..
»	»	»	..	..	..	..	..	..	S 200	1200	120	..	..	1	..	..
»	12/2 22	7[00] a.m.	..	..	..	..	..	..	S 150	4000	120	..	..	1	..	..
1240	13/2 22	4[00] a.m.	25°35′	74°45′	23°5	..	..	..	S 200	50	120	..	1	1	..	..
»	»	»	..	..	..	..	..	..	S 200	100	120	2	3	1	..	..
»	»	»	..	..	..	..	..	..	S 200	300	120	2	5	4	..	..
»	»	»	..	..	..	..	..	..	S 200	600	120	..	..	1	1	..
1241	13/2 22	8[45] p.m.	25°18′	74°00′	23°92	23°66	23°54	23°41	S 150	300	120	..	5	6	..	..
»	»	»	..	..	..	..	..	..	S 150	400	120	..	1	1	..	..
1242	14/2 22	8[00] p.m.	24°05′	74°36′	24°13	24°07	24°07	23°98	S 200	50	240	..	..	1	..	..
»	»	»	..	..	..	..	..	..	S 200	100	240	..	..	1	..	..
»	»	»	..	..	..	..	..	..	S 200	300	240	..	6	5	1	..
»	»	»	..	..	..	..	..	..	S 200	600	240	..	1	1	..	..
1243	17/2 22	7[30] p.m.	21°04′	73°48′	25°55	24°96	24°81	24°51	S 200	50	120	..	..	8	1	..
»	»	»	..	..	..	..	..	..	S 200	100	120	..	4	4	..	..
1245	17/2 22	6[30] p.m.	19°35′	73°27′	26°07	25°51	25°64	24°97	S 200	50	120	..	2	7	..	..
»	»	»	..	..	..	..	..	..	S 200	100	120	..	7	4	..	..
»	»	»	..	..	..	..	..	..	S 200	300	120	..	..	1	2	..
1247	20/2 22	4[00] a.m.	17°57′	72°51′	25°86	25°87	25°76	25°59	S 200	100	120	..	..	1	..	..
1250	26/2 22	3[30] a.m.	17°54′	67°30′	23°20	..	..	..	S 200	100	120	..	4	5	1	..
»	»	»	..	..	..	..	..	..	S 200	300	120	..	..	..	1	..
1256	4/3 22	7[30] p.m.	17°43′	64°56′	..	..	..	..	S 200	100	120	..	1	..	..	..
1260	8/3 22	7[50] p.m.	18°35′	66°00′	24°60	..	..	..	S 200	100	120	..	..	1	..	..
»	»	»	..	..	..	..	..	..	S 200	300	120	..	1	..	..	..

Station No.	Date	Hour	Position		Temperature				Gear	Wire out Meters	Duration of haul in minutes	Sizes (mm)				
			Lat.	Long.	Surface	50 m.	75 m.	100 m.				<10	10—15	15—25	25—40	>40
			N.	W.												
1261	9/3 22	4^00 a.m.	19°04′	65°43′	24°83	24°84	24°98	23°89	S 200	50	120	..	1	3	..	..
»	»	»	..	..	..	..	..	..	S 200	100	120	..	3	..	1	..
»	»	»	..	..	..	..	..	..	S 200	600	120	..	..	1	..	..
1266	13/3 22	7^00 p.m.	17°45′	64°55′,5	25°14	25°12	24°89	23°61	S 200	100	120	..	..	1	..	..
1269	16/3 22	0^40 a.m.	17°13′	64°58′	25°55	25°34	25°34	25°10	S 200	300	120	..	1	10	..	..
»	»	»	..	..	..	..	..	..	S 150	1500	180	..	..	1	..	..
»	»	»	..	..	..	..	..	..	S 150	3000	180	..	..	1	..	..
1273	24/3 22	7^15 p.m.	17°43′	64°56′	..	..	..	..	S 200	100	120	..	2	..	..	..
»	»	»	..	..	..	..	..	..	S 200	300	120	..	1	1	..	..
»	»	11^15 p.m.	..	..	24°90	..	..	..	S 200	700	120	..	..	..	1	..
1274	27/3 22	7^00 p.m.	17°43′	64°56′	24°80	..	..	..	S 200	100	60	..	10	2	..	..
»	»	»	..	..	..	..	..	..	S 200	600	60	..	..	..	1	..
1276	28/3 22	7^20 p.m.	17°43′	64°56′	24°70	..	..	..	S 200	100	60	..	6	1	..	..
1278	29/3 22	7^00 p.m.	17°43′	64°56′	24°70	..	..	..	S 200	100	120	..	2	3	..	..
»	»	»	..	..	..	..	..	..	S 200	300	120	..	..	..	1	..
1279	30/3 22	9^00 p.m.	17°43′	64°56′	24°60	..	..	..	S 200	100	120	..	1	1	..	..
1280	31/3 22	8^15 p.m.	17°43′	64°56′	24°80	..	..	..	S 200	100	120	..	6	..	..	..
1281	1/4 22	8^20 p.m.	17°43′	64°56′	24°90	..	..	..	S 200	100	120	..	2	1	..	..
1282	3/4 22	8^00 p.m.	16°03′	62°29′	26°10	..	..	..	S 200	100	60	..	..	1	..	..
»	»	»	..	..	..	..	..	..	S 200	300	60	..	..	..	1	..
1283	5/4 22	3^00 a.m.	14°38′	61°16′	26°10	..	..	..	S 200	100	120	..	..	1	..	..
»	»	»	..	..	..	..	..	..	S 200	300	120	..	..	1	2	..
1286	7/4 22	9^00 p.m.	15°17′	61°29′	26°10	..	..	..	S 200	100	120	..	..	..	1	..
1288	10/4 22	3^00 a.m.	16°04′	61°52′	25°80	..	..	..	S 200	1200	120	..	..	1	..	..
1289	15/4 22	0^40 a.m.	17°43′	64°56′	25°30	..	..	..	S 200	600	120	..	1	..	..	..
1293	17/4 22	7^40 p.m.	17°43′	64°56′	25°30	..	..	..	S 200	300	120	..	..	..	1	..
1294	18/4 22	7^30 p.m.	17°43′	64°56′	25°20	..	..	..	S 200	100	120	..	..	1	..	..
»	»	»	..	..	..	..	..	..	S 200	300	120	..	..	1	..	..
1296	19/4 22	8^15 p.m.	17°43′	64°56′	25°46	24°95	24°50	24°09	S 200	100	120	..	..	2	..	..
»	»	»	..	..	..	..	..	..	S 200	800	120	..	..	1	..	..
1320	27/3 22	7^20 p.m.	23°18′	56°58′	23°20	..	..	..	S 150	50	60	..	1	..	..	..
»	»	»	..	..	..	..	..	..	S 200	100	60	..	..	2	..	..
»	»	»	..	..	..	..	..	..	S 200	300	60	1	3	..	4	..
»	»	»	..	..	..	..	..	..	S 200	600	60	..	1	1	..	..
»	»	»	..	..	..	..	..	..	S 200	800	60	..	1	2	..	..
1321	28/4 22	7^20 p.m.	24°13′	54°36′	23°37	23°02	22°78	22°55	S 200	200	60	1	3	42	1	..
»	»	»	..	..	..	..	..	..	S 200	500	60	1	1	2	..	..
1322	29/4 22	7^00 p.m.	27°02′	53°39′	22°25	21°98	21°82	21°33	S 200	100	60	..	3	48	7	..
»	1/5 22	3^30 a.m.	..	..	..	..	..	..	S 200	100	180	..	..	16	4	..
»	»	»	..	..	..	..	..	..	S 200	150	180	..	5	92	9	..
»	29/4 22	9^45 p.m.	..	..	..	..	..	..	P 150	200	60	2	7	4	..	..
»	30/4 22	11^00 p.m.	..	..	..	..	..	..	P 150	200	60	3	..	..	..	..
»	1/5 22	3^30 a.m.	..	..	..	..	..	..	S 200	200	180	..	6	18	..	..
»	30/4 22	11^00 p.m.	..	..	..	..	..	..	P 150	300	60	..	2	1	..	..
»	30/4 22	»	..	..	..	..	..	..	P 150	400	60	2	3	..	..	..
»	29/4 22	9^45 p.m.	..	..	..	..	..	..	P 150	400	60	..	2	..	..	..
»	»	»	..	..	..	..	..	..	P 150	500	60	..	2	2	..	..
»	»	»	..	..	..	..	..	..	P 150	500	60	..	2	..	..	..
»	»	»	..	..	..	..	..	..	P 150	700	60	..	1	1	..	..
»	1/5 22	1^00 a.m.	..	..	..	..	..	..	P 150	700	60	..	..	2	..	..
»	29/4 22	7^00 p.m.	..	..	..	..	..	..	S 200	800	60	..	1	1	..	..
»	1/5 22	1^00 a.m.	..	..	..	..	..	..	P 150	800	60	..	..	1	..	..
»	30/4 22	0^45 a.m.	..	..	..	..	..	..	P 150	1900	120	..	1	..	..	..
»	»	»	..	..	..	..	..	..	P 150	2300	120	..	2	1	..	..
»	»	4^45 p.m.	..	..	..	..	..	..	P 150	4000	120	1	1	..	..	..

Station No.	Date	Hour	Position		Temperature				Gear	Wire out Meters	Duration of haul in minutes	Sizes (mm)				
			Lat.	Long.	Surface	50 m.	75 m.	100 m.				<10	10—15	15—25	25—40	>40
			N.	W.												
1323	1/5 22	7⁰⁰ p.m.	27°17′	54°35′	22°20	..	..	..	S 200	100	120	..	..	3	..	..
»	»	»	..	..	..	..	..	..	S 200	200	120	..	17	41	2	..
»	»	»	..	..	..	..	..	..	S 200	300	120	12	3	7	..	..
»	»	»	..	..	..	..	..	..	P 150	400	120	..	1	..	..	..
»	»	»	..	..	..	..	..	..	P 100	450	120	..	1	..	..	..
1326	2/5 22	9²⁰ p.m.	27°14′	51°25′	22°10	..	..	..	S 200	100	120	..	1	6	..	..
»	»	»	..	..	..	..	..	..	S 200	200	120	3	4	10	4	..
»	»	»	..	..	..	..	..	..	S 200	300	120	2	..	2	2	..
»	»	»	..	..	..	..	..	..	S 200	600	120	..	..	..	1	..
1327	3/5 22	3³⁰ a.m.	27°34′	51°47′	21°90	..	..	..	S 200	100	120	..	..	3	1	..
»	»	»	..	..	..	..	..	..	S 200	200	120	..	1	..	1	..
»	»	»	..	..	..	..	..	..	S 200	300	120	2	..	1	..	1
»	»	10¹⁵ a.m.	..	..	..	..	..	..	P 150	300	60	16	..	..	..	..
»	»	7³⁰ a.m.	..	..	..	..	..	..	P 100	450	90	1	..	..	..	..
»	»	»	..	..	..	..	..	..	P 150	600	90	1	2	..	..	..
1328	3/5 22	5⁰⁰ p.m.	27°05′	52°11′	22°30	..	..	..	P 150	400	90	..	1	..	..	..
»	»	»	..	..	..	..	..	..	P 100	550	90	2	..	..	..	..
»	»	8¹⁰ p.m.	..	..	..	..	..	..	P 150	700	90	..	1	..	..	..
»	»	»	..	..	..	..	..	..	P 150	800	90	..	1	2	..	..
»	»	»	..	..	..	..	..	..	P 150	1000	90	1	1	1	..	..
1329	4/5 22	8⁴⁵ a.m.	26°37′	53°22′	23°50	..	..	..	P 150	400	90	7	2	..	..	..
»	»	»	..	..	..	..	..	..	P 150	600	90	..	..	1	..	..
»	»	»	..	..	..	..	..	..	P 150	700	90	..	1	..	..	..
1330	4/5 22	8¹⁵ p.m.	26°37′	54°45′	22°90	..	..	..	P 100	200	90	..	..	..	1	..
»	»	»	..	..	..	..	..	..	P 150	400	90	1	..	5	..	..
»	»	»	..	..	..	..	..	..	P 150	500	90	..	2	..	..	..
»	»	»	..	..	..	..	..	..	P 150	600	90	..	..	2	..	..
1331	5/5 22	5⁴⁵ a.m.	26°37′	55°50′	..	..	..	..	P 100	200	90	4	..	..	..	..
»	»	»	..	..	..	..	..	..	P 150	700	90	1	1	..	..	..
»	»	9⁰⁰ a.m.	..	..	23°40	..	..	..	P 150	1200	120	..	2	..	..	..
1332	6/5 22	2¹⁵ a.m.	26°58′	56°58′	..	..	..	..	S 200	100	180	..	3	9	7	..
»	5/5 22	8¹⁵ p.m.	..	..	23°26	..	..	..	P 100	200	90	..	..	1	..	..
»	»	11²⁰ p.m.	..	..	..	..	..	..	P 150	200	90	12	10	27	2	..
»	6/5 22	2¹⁵ a.m.	..	..	..	..	..	..	S 200	200	180	1	9	6	4	..
»	5/5 22	11²⁰ p.m.	..	..	..	..	..	..	P 150	300	90	..	..	1	..	..
»	6/5 22	2¹⁵ a.m.	..	..	..	..	..	..	S 200	300	180	2	..	..	..	..
»	5/5 22	11²⁰ p.m.	..	..	..	..	..	..	P 150	400	90	..	..	1	..	..
1333	6/5 22	8⁴⁰ a.m.	27°24′	57°04′	23°01	20°77	20°60	19°98	P 100	300	90	..	..	1	..	..
1334	7/5 22	2²⁰ a.m.	27°28′	59°29′	23°20	..	..	..	S 200	100	120	..	..	5	1	..
»	»	»	..	..	..	..	..	..	S 200	200	120	..	17	3	7	..
»	»	»	..	..	..	..	..	..	S 200	300	120	1	..	2	..	..
»	»	»	..	..	..	..	..	..	E 300	1000	120	..	..	..	..	1
1335	8/5 22	2¹⁵ a.m.	28°02′	62°26′	22°56	20°41	19°96	19°53	S 150	50	180	..	..	1	..	..
»	»	»	..	..	..	..	..	..	S 200	100	180	..	..	7	2	1
»	»	»	..	..	..	..	..	..	S 200	150	180	2	5	11	12	2
»	»	»	..	..	..	..	..	..	S 200	200	180	1	17	20	11	..
1336	9/5 22	3⁰⁰ a.m.	28°15′	63°40′	22°70	..	..	..	S 200	150	120	..	..	4	1	..
»	»	»	..	..	..	..	..	..	S 200	200	120	..	1	7	8	..
»	»	7³⁰ a.m.	..	..	..	..	..	..	P 100	200	60	..	3	..	..	..
»	»	3³⁰ a.m.	..	..	..	..	..	..	S 200	300	120	..	1	1	1	3
»	»	7³⁰ a.m.	..	..	..	..	..	..	P 150	500	60	..	1	..	..	..
»	»	3³⁰ a.m.	..	..	..	..	..	..	S 150	600	120	..	1	..	1	..
1337	9/5 22	8³⁰ p.m.	29°36′	64°01′	..	..	..	..	S 150	50	120	..	..	2	5	..
»	»	»	..	..	..	..	..	..	S 200	100	120	..	..	2	2	..
»	»	»	..	..	..	..	..	..	S 200	200	120	4	..	2	..	..

Station No.	Date	Hour	Position Lat. N.	Position Long. W.	Temperature Surface	Temperature 50 m.	Temperature 75 m.	Temperature 100 m.	Gear	Wire out Meters	Duration of haul in minutes	Sizes (mm) <10	10—15	15—25	25—40	>40
1337	9/5 22	6⁰⁰ p.m.	29°36′	64°01′	22°40′t	..	..	..	P 150	300	60	7	8	..	..	..
»	»	8³⁰ p.m.	..	..	..	..	..	..	S 200	300	120	2	7	18	3	..
1339	10/5 22	7³⁰ p.m.	30°00′	64°38′	20°59	19°37	19°18	19°14	S 150	50	120	..	..	..	1	..
»	»	»	..	..	..	..	..	..	S 200	100	120	..	..	2	..	..
»	»	»	..	..	..	..	..	..	S 200	150	120	5	..	..	..	..
»	»	»	..	..	..	..	..	..	S 200	200	120	1	..	..	..	..
»	»	»	..	..	..	..	..	..	S 200	300	120	..	..	..	1	..
»	11/5 22	1²⁰ a.m.	..	..	..	..	..	..	P 150	300	60	..	..	..	1	..
1341	14/5 22	7³⁰ p.m.	33°15′	68°20′	..	..	..	..	S 200	100	120	..	..	1	..	..
»	»	»	..	..	..	..	..	..	S 200	150	120	..	..	2	..	..
»	»	»	..	..	..	..	..	..	S 200	200	120	..	..	..	1	..
1342	15/5 22	8⁰⁰ p.m.	34°00′	70°01′	20°83	19°86	19°04	18°92	S 150	50	120	..	..	3	..	..
»	»	»	..	..	..	..	..	..	S 200	100	120	..	..	..	2	..
»	»	»	..	..	..	..	..	..	S 200	150	120	..	..	3	2	..
»	»	»	..	..	..	..	..	..	S 200	200	120	..	..	..	3	..
1345	16/5 22	7³⁰ p.m.	35°07′	72°38′	21°40	..	..	..	S 200	100	120	..	..	..	1	..
»	»	»	..	..	..	..	..	..	S 200	200	120	..	..	..	1	..
1352	21/5 22	9³⁰ p.m.	35°42′	73°43′	25°60	..	..	..	S 150	50	120	..	1	1	..	..
»	»	»	..	..	..	..	..	..	S 200	100	120	..	5	5	1	..
»	»	»	..	..	..	..	..	..	S 200	150	120	1	16	17	1	..
»	»	»	..	..	..	..	..	..	S 200	200	120	5	8	8	2	..
»	»	»	..	..	..	..	..	..	S 200	300	120	..	1	3	1	..
1353	23/5 22	7⁵⁰ p.m.	33°51′	66°43′	21°90	..	..	..	S 150	50	120	..	..	1	2	..
»	»	»	..	..	..	..	..	..	S 200	300	120	..	..	..	..	1
1355	30/5 22	8³⁰ p.m.	31°48′	63°38′	22°30	..	..	..	S 200	100	120	..	..	1	1	..
»	»	»	..	..	..	..	..	..	S 200	200	120	..	2	12	5	1
1356	1/6 22	2³⁰ a.m.	29°56′	59°33′	22°65	20°65	20°23	19°86	S 150	50	120	..	..	1	..	..
»	»	»	..	..	..	..	..	..	S 200	100	120	1	3	4	3	..
»	»	»	..	..	..	..	..	..	S 200	200	120	1	1	..	2	..
1358	3/6 22	1⁵⁰ a.m.	28°15′	56°00′	23°30	..	..	..	S 150	50	120	..	..	..	1	..
»	»	»	..	..	..	..	..	..	S 200	100	120	..	3	14	9	..
»	»	»	..	..	..	..	..	..	S 200	150	120	..	14	11	5	2
»	»	»	..	..	..	..	..	..	S 200	200	120	29	12	11	3	1
»	»	»	..	..	..	..	..	..	S 200	300	120	..	1	1	..	..
»	»	»	..	..	..	..	..	..	S 150	600	120	..	1	..	..	..
»	2/6 22	3³⁰ p.m.	..	..	..	..	..	..	S 150	2000	360	..	1	..	..	..
1359	3/6 22	0⁵⁰ p.m.	27°35′	55°03′	24°60	..	..	..	P 100	200	60	..	..	1	..	..
»	»	»	..	..	..	..	..	..	P 150	300	60	..	1	..	..	..
1360	4/6 22	2²⁵ a.m.	26°56′	53°09′	24°00	..	..	..	S 200	100	120	..	1	7	4	..
»	»	»	..	..	..	..	..	..	S 200	150	120	..	27	8	3	..
»	»	»	..	..	..	..	..	..	S 200	200	120	2	1	1	4	..
»	»	5⁵⁰ a.m.	..	..	..	..	..	..	P 100	700	90	..	2	..	..	..
1361	4/6 22	9²⁰ p.m.	27°07′	51°10′	23°50	..	..	..	S 200	200	120	..	4	2	..	..
1362	6/6 22	2³⁰ a.m.	28°57′	47°24′	22°91	21°68	21°27	20°61	S 200	100	120	..	..	23	14	..
»	»	»	..	..	..	..	..	..	S 200	150	120	..	1	10	2	..
»	»	»	..	..	..	..	..	..	S 200	200	120	..	2	21	13	1
»	»	»	..	..	..	..	..	..	S 200	300	120	..	..	..	2	..
1363	7/6 22	2³⁰ a.m.	30°25′	44°46′	23°30	..	..	..	S 200	100	120	..	..	2	3	..
»	»	»	..	..	..	..	..	..	S 200	150	120	..	..	5	1	..
»	»	»	..	..	..	..	..	..	S 200	200	120	..	..	1	3	..
1365	8/6 22	2³⁰ a.m.	31°47′	41°41′	21°71	19°67	18°44	18°13	S 200	100	120	..	..	1	..	..
1366	9/6 22	2³⁰ a.m.	32°30′	40′04	21°60	..	..	..	S 200	100	120	..	..	2	1	..
»	»	»	..	..	..	..	..	..	S 150	150	120	..	..	2	..	..
»	»	»	..	..	..	..	..	..	S 200	300	120	..	..	1	2	..

Record of the hauls of *Paralepis thermophilus.*

Station No.	Date	Hour	Position Lat.	Position Long.	Temperature Surface	Temperature 25 m.	Temperature 50 m.	Gear	Wire out Meters	Duration of haul in minutes	Sizes (mm) 5—10	10—15	15—25	25—40
			N.	W.										
440	19/11 11	9[10] p.m.	18°45′	62°20′	27°7	..	..	S 150	56	30	1	2	1	..
			S.											
470	18/12 11	8[10] p.m.	0°38′	31°31′	..	..	..	S 150	15	30	..	..	1	..
471	6/4 12	6[50] p.m.	20°44′	39°53′	..	..	..	S 150	15	30	..	8	3	..
»	»	6[55] p.m.	..	..	..	..	..	S 100	38	30	..	3	8	..
			N.											
776	9/3 14	11[00] p.m.	18°00′	64°48′	25°2	..	..	S 150	180	30	2	1	2	..
777	12/3 14	11[00] p.m.	17°49′	64°51′	25°1	..	..	S 150	180	30	..	2	2	..
778	21/3 14	4[00] a.m.	17°56′	64°46′	25°1	..	..	S 150	180	30	..	4	1	..
779	22/3 14	9[00] p.m.	18°08′	64°51′	25°5	..	..	S 150	180	30	..	4	1	..
780	24/3 14	1[00] a.m.	17°50′	64°44′	25°5	..	..	S 150	180	30	..	3	1	..
782	6/4 14	10[00] p.m.	18°08′	64°53′	25°5	..	..	S 150	180	30	..	1	1	..
783	15/4 14	8[00] p.m.	18°00′	64°48′	25°7	..	..	S 150	180	30	..	4	1	..
784	18/4 14	3[30] a.m.	17°48′	64°42′	25°8	..	..	S 150	180	30	..	5	..	..
819	23/6 15	4[00] a.m.	19°10′	61°4′	27°3	..	..	S 150	170	56	..	1	..	..
848	2/6 20	3[00] a.m.	18°00′	64°41′	26°0	..	..	S 200	300	120	..	..	1	..
893	29/7 20	4[30] p.m.	33°07′	77°00′	26°5	..	..	S 150	100	120	..	..	..	1
901	22/2 21	8[00] p.m.	17°55′	64°48′	..	..	..	P 150	100	120	2	2	3	..
»	»	3[30] p.m.	..	..	27°0	..	..	P 150	200	120	14	7	..	..
952	13/5 21	8[00] p.m.	17°55′	64°48′	26°5	..	..	S 200	50	120	..	1	..	..
»	»	11[00] p.m.	..	..	..	..	..	S 200	200	120	..	2	1	..
1159	29/10 21	10[45] p.m.	17°55′	24°35′	25°40	25°42	25°39	S 200	100	120	..	..	3	..
1172	14/11 21	6[50] p.m.	7°22′	46°51′	28°40	..	26°22	S 200	50	120	..	3	..	..
»	»	»	..	..	..	..	..	S 200	100	120	9	29	2	..
»	»	»	..	..	..	..	..	S 200	300	120	1	1	..	..
1173	15/11 21	7[10] p.m.	6°18′	48°58′	27°53	..	27°16	S 200	100	60	..	1	..	..
1174	16/11 21	7[00] p.m.	5°35′	51°08′	27°99	..	23°44	S 200	50	120	..	2	7	..
»	»	»	..	..	..	..	..	S 200	100	120	11	2	4	1
»	»	»	..	..	..	..	..	S 200	300	120	..	..	5	5
»	»	»	..	..	..	..	..	S 200	600	120	..	1	..	..
1175	17/11 21	3[50] a.m.	5°06′	51°35′	27°70	..	..	S 200	50	120	..	6	11	..
»	»	»	..	..	..	..	..	S 200	100	120	..	9	1	..
»	»	»	..	..	..	..	..	S 200	200	120	2	9	23	..
1178	19/11 21	6[50] p.m.	10°24′	54°38′	27°60	27°71	26°50	S 200	50	120	..	3	..	..
»	»	»	..	..	..	..	..	S 200	100	120	..	4	2	..
»	»	»	..	..	..	..	..	S 200	300	120	..	2	..	..
»	»	»	..	..	..	..	..	S 200	600	120	..	1	..	..
1180	21/11 21	0[10] a.m.	12°11′	57°12′	..	..	..	S 200	100	120	..	1	..	..
»	20/11 21	9[30] p.m.	..	..	..	..	..	S 200	300	120	..	4	1	..
1181	21/11 21	6[00] p.m.	13°07′	57°20′	27°75	27°69	27°88	S 150	1000	180	..	1	..	..
»	»	»	..	..	..	..	..	S 150	3000	180	..	1	1	..
»	»	»	..	..	..	..	..	S 150	4000	180	..	3	..	..
1182	23/11 21	10[20] p.m.	13°03′	59°50′	27°53	27°57	27°46	S 200	50	120	..	5	..	..
»	»	»	..	..	..	..	..	S 200	100	120	..	5	3	..
»	»	»	..	..	..	..	..	S 200	300	120	..	1	28	3
1183	24/11 21	10[45] p.m.	13°47′	61°26′	27°79	27°66	27°25	S 200	50	120	4	36	26	..
»	»	»	..	..	..	..	..	S 200	100	120	7	32	14	..
»	»	»	..	..	..	..	..	S 200	300	120	..	2	12	1
»	»	»	..	..	..	..	..	S 200	600	120	..	..	3	2
»	»	4[30] p.m.	..	..	..	..	..	S 150	3500	180	..	4	1	..
1184	25/11 21	10[15] p.m.	15°08′	61°31′	27°20	..	..	S 200	100	120	..	6	8	..
»	»	»	..	..	..	..	..	S 200	300	120	..	..	3	..
»	»	»	..	..	..	..	..	S 200	600	120	..	..	2	..
»	»	»	..	..	..	..	..	S 200	800	120	..	..	1	..

Station No.	Date	Hour	Position		Temperature			Gear	Wire out Meters	Duration of haul in minutes	Sizes (mm)			
			Lat.	Long.	Surface	25 m.	50 m.				5—10	10—15	15—25	25—40
			N.	W.										
1186	1/12 21	0^{45} a.m.	17°58.5′	64°41′	..	..	..	S 200	50	180	3	22	11	..
»	»	»	..	..	..	..	..	S 200	100	180	3	3	1	..
»	»	«	..	..	..	..	..	S 200	300	180	..	..	4	1
»	30/11 21	6^{15} p.m.	..	..	..	..	..	S 150	4000	240	..	1	..	..
1188	7/12 21	3^{20} a.m.	17°43.7′	64°57′	..	..	..	S 200	50	120	..	2	1	..
»	»	»	..	..	..	..	..	S 200	100	120	..	9	2	..
»	»	»	..	..	..	..	..	S 200	300	120	..	2	5	..
1189	8/12 21	11^{55} p.m.	17°58.5′	64°41′	27°09	27°05	27°08	S 200	300	300	1	..	2	..
»	»	2^{40} p.m.	..	..	..	..	..	S 150	2000	300	1	1	..	..
»	»	»	..	..	..	..	..	S 150	4000	300	..	..	1	..
1190	12/12 21	6^{45} p.m.	17°58.5′	64°45′	..	..	..	S 200	50	120	..	3	2	..
»	13/12 21	4^{00} a.m.	..	..	..	..	..	S 200	50	120	2	1	5	..
»	12/12 21	6^{45} p.m.	..	..	..	..	..	S 200	100	120	2	1	5	..
»	13/12 21	4^{00} a.m.	..	..	..	..	..	S 200	100	120	4	21	9	..
»	12/12 21	6^{45} p.m.	..	..	..	..	..	S 200	300	120	4	..	5	..
»	13/12 21	4^{00} a.m.	..	..	..	..	..	S 200	300	120	..	..	7	..
»	12/12 21	6^{45} p.m.	..	..	..	..	..	S 200	1000	120	..	..	1	..
1191	14/12 21	6^{50} p.m.	17°49′	64°54′	..	..	..	S 200	50	90	5	6	1	..
»	15/12 21	4^{00} a.m.	..	..	26°80	..	..	S 200	50	90	2	2	..	..
»	14/12 21	6^{50} p.m.	..	..	..	..	..	S 200	100	90	4	4	1	..
»	15/12 21	4^{00} a.m.	..	..	..	..	..	S 200	100	90	..	1	1	..
»	14/12 21	6^{50} p.m.	..	..	..	..	..	S 200	300	90	1	2	1	1
»	15/12 21	4^{00} a.m.	..	..	..	..	..	S 200	300	90	..	2	..	..
»	14/12 21	6^{50} p.m.	..	..	..	..	..	S 200	600	90	..	1	..	..
»	15/12 21	4^{00} a.m.	..	..	..	..	..	S 200	600	90	..	1	..	..
1192	15/12 21	7^{35} p.m.	17°43.4′	64°54.3′	..	..	..	S 200	50	120	..	1	..	..
»	16/12 21	2^{30} a.m.	..	..	26°80	..	..	S 200	50	120	3	7	..	..
»	15/12 21	7^{35} p.m.	..	..	..	..	..	S 200	100	120	2	1	3	..
»	16/12 21	2^{30} a.m.	..	..	..	..	..	S 200	100	120	4	4	..	..
«	15/12 21	7^{35} p.m.	..	..	..	..	..	S 200	300	120	1	1	1	1
»	16/12 21	2^{30} a.m.	..	..	..	..	..	S 200	300	120	1	5	2	..
»	»	»	..	..	..	..	..	S 200	600	120	..	..	4	1
1194	21/12 21	11^{50} p.m.	17°58.5′	64°41′	..	..	..	S 200	50	120	..	2	1	..
»	»	9^{45} p.m.	..	..	26°50	..	..	S 150x	300	90	..	4	1	..
»	»	11^{50} p.m.	..	..	..	..	..	S 200	300	120	..	..	1	..
»	22/12 21	2^{50} a.m.	..	..	..	..	..	S 100x	300	90	2	6	5	..
»	21/12 21	9^{45} p.m.	..	..	..	..	..	S 150	306	90	..	5	..	..
»	»	»	..	..	..	..	..	S 150	312	90	3	9	1	..
»	22/12 21	2^{50} a.m.	..	..	..	..	..	S 100	315	90	..	1	..	..
»	21/12 21	9^{45} p.m.	..	..	..	..	..	S 200	320	90	2	3	2	..
»	»	11^{50} p.m.	..	..	..	..	..	S 200	600	120	..	1	..	..
1195	3/1 22	3^{50} a.m.	19°01′	65°23′	26°03	26°12	26°73	S 200	50	120	..	4	1	..
»	»	»	..	..	..	..	..	S 200	100	120	3	2	2	..
»	»	0^{50} a.m.	..	..	..	..	..	S 200	300	120	..	1	4	..
1196	4/1 22	0^{20} a.m.	17°43′	64°56′	26°10	..	..	S 200	100	120	..	1	3	..
1198	4/1 22	7^{50} p.m.	17°43′	64°56′	26°20	..	..	S 200	200	120	..	..	3	..
»	»	»	..	..	..	..	..	S 200	800	120	..	..	1	..
1202	10/1 22	4^{50} a.m.	9°40′	79°56′	26°44	26°61	26°76	S 200	50	120	..	..	3	..
»	»	»	..	..	..	..	..	S 200	100	120	1	3	..	..
1214	27/1 22	2^{00} a.m.	14°21′	76°50′	26°41	26°36	26°17	S 150	50	120	2	5	4	..
»	»	»	..	..	..	..	..	S 150	100	120	2	5	4	..
»	26/1 22	10^{45} p.m.	..	..	..	..	..	S 150	300	120	..	..	..	1
»	»	»	..	..	..	..	..	S 150	600	120	..	1	..	..
1215	27/1 22	10^{45} p.m.	16°06′	76°02′	..	..	..	S 150	50	120	..	..	3	..
»	»	»	..	..	..	..	..	S 150	100	120	2	3	1	..

Station No.	Date	Hour	Position		Temperature			Gear	Wire out Meters	Duration of haul in minutes	Sizes (mm)			
			Lat.	Long.	Surface	25 m.	50 m.				5—10	10—15	15—25	25—40
			N.	W.										
1215	27/1 22	7³⁰ p.m.	16°06′	76°02′	26°10	..	..	S 150	300	120	..	..	1	..
»	»	»	..	..	..	..	..	S 150	1000	120	..	1	..	..
1216	28/1 22	9⁴⁵ p.m.	18°22′	78°38′	26°20	..	..	S 200	50	120	..	7	2	..
»	»	»	..	..	..	..	..	S 200	100	120	..	1	..	..
»	»	»	..	..	..	..	..	S 200	600	120	..	..	1	..
1218	30/1 22	6⁵⁰ p.m.	20°08′	82°59′	26°00	..	..	S 200	50	60	..	2	8	..
»	»	»	..	..	..	..	..	S 200	300	60	..	..	1	..
»	»	»	..	..	..	..	..	S 200	800	60	..	..	1	..
1223	1/2 22	7⁴⁰ p.m.	22°06′	84°58′	..	..	..	S 200	50	120	4	2	3	..
»	»	»	..	..	..	..	..	S 200	100	120	4	5	7	..
»	»	10⁴⁵ p.m.	..	..	25°80	..	..	S 200	300	120	..	..	4	1
»	»	»	..	..	..	..	..	S 200	500	120	..	..	4	1
»	»	»	..	..	..	..	..	E 300	600	120	..	1	..	..
1225	2/2 22	9⁴⁰ p.m.	23°58′	83°22′	24°81	24°76	24°76	S 200	100	120	..	..	2	..
1229	4/2 22	3³⁰ a.m.	23°13′	82°21′	25°10	25°14	25°23	S 200	50	120	..	..	1	..
»	»	»	..	..	..	..	..	S 200	100	120	..	..	2	..
1238	11/3 22	4⁰⁰ a.m.	26°13′	78°48′	23°50	23°50	23°52	S 200	50	120	..	1	..	..
»	»	»	..	..	..	..	..	S 200	100	120	1	1	..	..
1239	12/2 22	2¹⁵ a.m.	25°50′	76°55′	23°42	23°42	23°35	S 200	50	120	..	1	..	..
»	»	»	..	..	..	..	..	S 200	100	120	..	..	1	..
»	11/3 22	8¹⁵ p.m.	..	..	..	..	..	S 200	800	120	..	..	1	..
1242	14/2 22	8⁰⁰ p.m.	24°05′	74°36′	24°13	24°11	24°07	S 200	50	240	1	..	..	..
1243	16/2 22	7³⁰ p.m.	21°04	73°48′	25°55	25°13	24°96	S 200	50	120	4	2	..	..
»	»	»	..	..	..	..	..	S 200	100	120	1	5	..	..
1245	17/2 22	6³⁰ p.m.	19°35′	73°27′	26°07	25°71	25°51	S 200	50	120	1	7	9	..
»	»	»	..	..	..	..	..	S 200	100	120	..	3	6	..
1247	20/2 22	4⁰⁰ a.m.	17°57′	72°51′	25°86	25°86	25°87	S 200	100	120	..	..	5	..
1250	26/2 22	3³⁰ a.m.	17°54′	67°30′	25°50	..	..	S 200	100	120	3	3	8	..
1253	2/3 22	8⁰⁰ p.m.	17°43′	64°56′	..	..	..	S 200	50	120	..	1	..	..
»	»	»	..	..	..	..	..	S 200	100	120	..	..	1	..
»	»	»	..	..	..	..	..	S 200	300	120	..	..	..	3
1256	4/3 22	7³⁰ p.m.	17°43′	64°56′	..	..	..	S 200	100	120	..	3	..	..
»	»	»	..	..	..	..	..	S 200	300	120	..	..	..	1
»	»	»	..	..	..	..	..	S 200	800	120	..	..	..	1
1257	6/3 22	0¹⁰ a.m.	17°43′	64°56′	..	..	..	S 200	100	120	..	..	1	..
»	»	»	..	..	..	..	..	S 200	300	120	..	..	..	1
1266	13/3 22	10¹⁵ p.m.	17°45′	64°55.5′	25°15	25°14	25°09	S 200	25	120	1	1	..	..
»	»	»	..	..	..	..	..	S 200	50	120	..	4	1	..
»	»	»	..	..	..	..	..	S 200	100	120	2	4	2	..
»	»	»	..	..	..	..	..	S 200	300	120	..	..	5	..
1268	15/3 22	2⁰⁰ a.m.	17°43′	64°56′	24°80	..	..	S 200	100	120	1	..	..	..
»	»	»	..	..	..	..	..	S 200	300	120	..	..	3	1
1269	16/3 22	0⁴⁰ a.m.	17°13′	64°58′	25°55	25°43	25°34	S 200	300	120	..	3	4	..
»	15/3 22	6⁰⁰ p.m.	..	..	..	..	..	S 150	4000	180	..	2	..	..
1272	23/3 22	11³⁰ p.m.	17°43′	64°56′	24°80	..	..	S 200	50	120	5	16	6	..
»	»	»	..	..	..	..	..	S 200	100	120	8	30	7	1
»	»	»	..	..	..	..	..	S 200	300	120	..	1	7	1
»	»	»	..	..	..	..	..	S 200	600	120	..	1	1	..
1273	24/3 22	11¹⁵ p.m.	17°43′	64°56′	24°90	..	..	S 200	50	120	4	22	5	..
»	»	7¹⁵ p.m.	..	..	..	..	..	S 200	100	120	3	8	4	..
»	»	»	..	..	..	..	..	S 200	300	120	1	1	3	..
»	»	11¹⁵ p.m.	..	..	..	..	..	S 200	500	120	..	1	1	..
»	»	7¹⁵ p.m.	..	..	..	..	..	S 200	800	120	..	..	2	..
1274	27/3 22	9²⁰ p.m.	17°43′	64°56′	24°80	..	..	S 200	50	60	..	7	5	..
»	»	»	..	..	..	..	..	S 200	100	60	4	5	10	1

Station No.	Date	Hour	Position		Temperature			Gear	Wire out Meters	Duration of haul in minutes	Sizes (mm)				
			Lat.	Long.	Surface	25 m.	50 m.				5—10	10—15	15—25	25—40	>40
			N.	W.											
1276	28/3 22	7²⁰ p.m.	17°43′	64°56′	24°70	..	..	S 200	100	60	2	..	4	..	..
»	»	»	..	..	..	..	..	S 200	600	60	..	..	1	..	..
1278	29/3 22	7⁰⁰ p.m.	17°43′	64°56′	24°70	..	..	S 200	100	120	..	4	2	..	..
»	»	»	..	..	..	..	..	S 200	300	120	..	..	4	..	..
1279	30/3 22	9⁰⁰ p.m.	17°43′	64°56′	24°60	..	..	S 200	100	120	4	4	7	..	..
»	»	»	..	..	..	..	..	S 200	300	120	..	..	4	..	..
1280	31/3 22	8¹⁵ p.m.	17°43′	64°56′	24°80	..	..	S 200	100	120	2	3	11	..	..
»	»	»	..	..	..	..	..	S 200	300	120	..	1	4	1	..
1281	1/4 22	11³⁰ p.m.	17°43′	64°56′	..	..	..	S 200	50	120	4	1	6	..	..
»	»	8²⁰ p.m.	..	..	24°90	..	..	S 200	100	120	..	2	4	..	..
»	»	»	..	..	..	..	..	S 200	300	120	..	..	2	..	..
1282	3/4 22	8⁰⁰ p.m.	16°03′	62°29′	26°10	..	..	S 200	100	60	1	..	3	..	..
»	»	»	..	..	..	..	..	S 200	300	60	..	..	1	2	..
»	»	»	..	..	..	..	..	S 200	800	60	..	..	..	1	..
1283	5/4 22	3⁰⁰ a.m.	14°38′	61°16′	26°1	..	..	S 200	100	120	7	13	..	..	..
»	»	»	..	..	..	..	..	S 200	300	120	..	..	..	1	..
1284	6/4 22	5³⁰ a.m.	14°38′	61°16′	..	..	..	S 200	50	60	..	1	..	..	..
»	»	3⁰⁰ a.m.	..	..	26°00	..	..	S 200	100	120	31	7	..	..	..
»	»	»	..	..	..	..	..	S 200	300	120	1	..	..	1	1
1285	7/4 22	3¹⁵ a.m.	14°38′	61°16′	26°39	26°13	25°82	S 200	100	120	23	6	4	..	..
»	»	»	..	..	..	..	..	S 200	300	120	..	3	..	..	..
1286	7/4 22	9⁰⁰ p.m.	15°17′	61°29′	26°10	..	..	S 200	50	120	..	7	16	..	..
»	»	»	..	..	..	..	..	S 200	100	120	6	4	..	..	..
»	»	»	..	..	..	..	..	S 200	600	120	..	..	..	2	..
1287	8/4 22	8¹⁰ p.m.	16°04′	61°52′	26°4	..	..	S 200	50	120	..	10	13	..	..
»	»	»	..	..	..	..	..	S 200	100	120	1	1	2	..	..
1289	15/4 22	0⁴⁰ a.m.	17°43′	64°56′	25°30	..	..	S 200	100	120	..	..	1	..	..
»	»	»	..	..	..	..	..	S 200	300	120	..	..	2	1	..
»	»	»	..	..	..	..	..	S 200	600	120	..	..	2	..	..
»	»	»	..	..	..	..	..	S 200	800	120	..	..	1	..	..
»	»	4⁰⁰ a.m.	..	..	..	..	..	S 200	1000	120	..	2	..	..	..
1291	15/4 22	7³⁰ p.m.	17°43′	64°56′	25°40	..	..	S 200	100	120	..	..	1	1	..
»	»	»	..	..	..	..	..	S 200	300	120	..	..	6	1	..
»	»	»	..	..	..	..	..	S 200	600	120	..	..	1	1	..
1292	16/4 22	7³⁰ p.m.	17°43′	64°56′	25°40	..	..	S 150	50	120	..	2	1	..	..
»	»	»	..	..	..	..	..	S 200	100	120	..	..	4	..	..
»	»	»	..	..	..	..	..	S 200	300	120	..	..	3	..	.
»	»	»	..	..	..	..	..	S 200	800	120	..	1	..	..	..
1293	17/4 22	7⁴⁰ p.m.	17°43′	64°56′	25°30	..	..	S 150	50	120	..	3	2	..	..
»	»	»	..	..	..	..	..	S 200	100	120	..	..	2	..	..
»	»	»	..	..	..	..	..	S 200	300	120	..	..	8	..	..
»	»	»	..	..	..	..	..	S 200	600	120	..	..	1	1	..
1294	18/4 22	7³⁰ p.m.	17°43′	64°56′	25°20	..	..	S 200	100	120	..	3	5	..	..
»	»	»	..	..	..	..	..	S 200	300	120	..	1	3	..	..
»	»	»	..	..	..	..	..	S 200	600	120	..	..	1	..	..
1296	19/4 22	8¹⁵ p.m.	17°43′	64°56′	25°46	25°43	24°95	S 150	50	120	..	1	..	..	..
»	»	»	..	..	..	..	..	S 200	100	120	..	4	1	..	..
»	»	»	..	..	..	..	..	S 200	300	120	..	2	6	..	..
»	»	»	..	..	..	..	..	S 200	600	120	..	..	1	..	..
1310	22/4 22	4¹⁰ a.m.	17°43′	64°56′	..	..	..	S 200	300	60	..	1	1	1	..
1314	22/4 22	7⁵⁰ p.m.	17°43′	64°56′	..	..	..	S 150	50	60	..	1	..	..	..
»	»	»	..	..	..	..	..	S 200	100	60	..	1	..	..	..
1345	16/5 22	7³⁰ p.m.	35°07′	72°38′	21°40	..	..	S 200	300	120	..	..	..	1	..
1352	21/5 22	9³⁰ p.m.	35°42′	73°43′	25°60	..	..	S 150	50	120	3	9	3	..	..
»	»	»	..	..	..	..	..	S 200	100	120	..	4	2	..	..
»	»	»	..	..	..	..	..	S 200	200	120	..	..	7	..	

Record of the hauls of *Paralepis intermedius* (?).

Station No.	Date	Hour	Position Lat. N.	Position Long. W.	Temperature Surface	Temperature 25 m.	Temperature 50 m.	Gear	Wire out Meters	Duration of haul in minutes	Sizes (mm) <10	10—15	15—25	25—40	>40
723	3/3 13	8^00 p.m.	6°21′	27°02′	25°0	..	..	S 150	120	35	..	..	..	1	..
893	29/7 20	4^30 p.m.	33°07′	77°00′	26°5	..	..	S 150	100	120	..	..	1	..	..
»	»	»	..	..	..	..	..	S 150	150	120	..	..	1	..	..
1159	29/10 21	10^45 p.m.	17°55′	24°35′	25°40	25°42	25°39	S 200	100	120	..	..	3	..	..
1168	12/11 21	4^00 a.m.	9°30′	42°41′	27°50	..	..	S 200	100	120	..	..	..	1	..
1172	14/11 21	6^50 p.m.	7°22′	46°51′	28°40	..	26°22	S 200	50	120	..	1	..	..	..
»	»	»	..	..	..	..	..	S 200	100	120	16	68	16	..	..
»	»	»	..	..	..	..	..	S 200	300	120	4	2	2	1	3
»	»	»	..	..	..	..	..	S 200	600	120	..	1	1	..	..
1174	16/11 21	7^00 p.m.	5°35′	51°08′	27°99	..	23°44	S 200	50	120	..	23	14	..	..
»	»	»	..	..	..	..	..	S 200	100	120	15	15	9	..	..
»	»	»	..	..	..	..	..	S 200	300	120	..	1	35	8	4
1175	17/11 21	3^50 a.m.	5°06′	51°35′	27°70	..	..	S 200	50	120	..	14	12	..	..
»	»	»	..	..	..	..	..	S 200	100	120	1	6	2	..	..
»	»	»	..	..	..	..	..	S 200	200	120	1	33	21	..	..
1178	19/11 21	6^50 p.m.	10°24′	54°38′	27°60	27°71	26°50	S 200	50	120	..	1	7	..	..
»	»	»	..	..	..	..	..	S 200	100	120	..	..	3	1	..
»	»	»	..	..	..	..	..	S 200	300	120	..	..	1	1	..
1188	7/12 21	3^20 a.m.	17°43.7′	64°57′	..	..	..	S 200	100	120	..	..	1	..	..
1189	8/12 21	11^55 p.m.	17°58.5′	64°41′	27°09	27°05	27°08	S 200	50	300	..	..	1	..	..
»	»	»	..	..	..	..	..	S 200	100	300	..	2	..	..	..
1190	13/12 21	4^00 a.m.	17°58.5′	64°45′	..	..	..	S 200	100	120	..	3	1	..	..
»	»	»	..	..	..	..	..	S 200	300	120	..	..	1	..	..
»	12/12 21	6^45 p.m.	..	..	..	..	..	S 200	300	120	..	1	1	1	..
1191	14/12 21	6^50 p.m.	17°49′	64°54′	..	..	..	S 200	300	90	..	..	2	..	..
»	15/12 21	4^00 a.m.	..	..	26°80	..	..	S 200	600	90	..	1	..	1	..
1192	15/12 21	7^35 p.m.	17°43′,4	64°54′,3	..	..	..	S 200	50	120	..	..	1	..	..
»	»	»	..	..	..	..	..	S 200	300	120	..	2	1	..	..
»	16/12 21	2^30 a.m.	..	..	26°80	..	..	S 200	600	120	..	..	2	..	..
1193	20/12 21	4^50 a.m.	18°10′	64°55′	26°30	..	..	S 200	70	90	..	..	1	..	..
1194	21/12 21	11^50 p.m.	17°58.5′	64°41′	..	..	..	S 200	50	120	..	1	..	..	..
»	»	9^45 p.m.	..	..	26°50	..	..	S 150x	300	90	..	3	..	..	..
»	»	»	..	..	..	..	..	S 150	312	90	..	1	..	..	..
»	»	»	..	..	..	..	..	S 200	320	90	1	..	..	..	..
»	»	11^50 p.m.	..	..	..	..	..	S 200	600	120	1	..	..	..	..
1196	4/1 22	0^20 a.m.	17°43′	64°56′	26°10	..	..	S 200	300	120	..	..	4	..	..
1198	4/1 22	7^50 p.m.	17°43′	64°56′	26°20	..	..	S 200	200	120	..	..	1	..	..
1202	10/1 22	4^50 a.m.	9°40′	79°56′	26°44	26°61	26°76	S 200	50	120	..	..	1	..	..
»	»	»	..	..	..	..	..	S 200	100	120	..	2	1	..	..
1214	27/1 22	2^00 a.m.	14°21′	76°50′	26°41	26°36	26°17	S 150	100	120	..	2	..	..	..
1215	27/1 22	10^45 p.m.	16°06′	76°02′	..	..	..	S 150	100	120	1	..	..	..	..
»	»	7^30 p.m.	..	..	26°10	..	..	S 150	300	120	..	..	1	1	..
»	»	»	..	..	..	..	..	S 150	1000	120	..	..	1	..	..
1223	1/2 22	7^40 p.m.	22°06′	84°58′	..	..	..	S 200	50	120	..	2	1	..	..
»	»	»	..	..	..	..	..	S 200	100	120	..	1	..	..	..
»	»	10^45 p.m.	..	..	25°80	..	..	S 200	500	120	..	..	1	..	..
1228	3/2 22	8^00 p.m.	23°35′	81°54′	25°41	25°13	25°08	S 200	600	120	..	..	1	..	..
1239	12/2 22	2^15 a.m.	25°50′	76°55′	23°42	23°42	23°35	S 200	50	120	..	2	..	..	..
»	»	»	..	..	..	..	..	S 200	100	120	..	2	..	..	..
»	»	»	..	..	..	..	..	S 200	600	120	..	1	1	..	..
1266	13/3 22	7^00 p.m.	17°45′	64°55.5′	25°15	25°14	25°09	S 200	300	120	..	..	1	..	..
1269	15/3 22	6^00 p.m.	17°13′	64°58′	25°55	25°43	25°34	S 150	4000	180	..	1	..	..	..
1273	24/3 22	11^15 p.m.	17°43′	64°56′	24°90	..	..	S 200	50	120	..	1	..	..	..
»	»	7^15 p.m.	..	..	..	..	..	S 200	100	120	2	2	2	..	..

Station No.	Date	Hour	Position		Temperature			Gear	Wire out Meters	Duration of haul in minutes	Sizes (mm)			
			Lat. N.	Long. W.	Surface	25 m.	50 m.				<10	10—15	15—25	25—40
1273	24/3 22	7[15] p.m.	17°43′	64°56′	24°90	..	..	S 200	300	120	..	..	1	..
1274	27/3 22	7[00] p.m.	17°43′	64°56′	24°80	..	..	S 200	100	60	..	..	3	..
»	»	»	..	..	..	..	..	S 200	300	60	..	..	2	..
1278	29/3 22	7[00] p.m.	17°43′	64°56′	24°70	..	..	S 200	300	120	..	..	..	1
1279	30/3 22	9[00] p.m.	17°43′	64°56′	24°60	..	..	S 200	100	120	..	1	..	..
»	»	»	..	..	..	..	..	S 200	300	120	..	1	1	..
1280	31/3 22	8[15] p.m.	17°43′	64°56′	24°80	..	..	S 200	300	120	..	1	1	..
1281	1/4 22	11[30] p.m.	17°43′	64°56′	..	..	..	S 200	50	120	1	..	..	..
»	»	8[20] p.m.	..	..	24°90	..	..	S 200	100	120	2	1	..	..
»	»	»	..	..	..	..	..	S 200	300	120	..	..	2	..
1283	5/4 22	3[00] a.m.	14°38′	61°16′	26°1	..	..	S 200	100	120	..	3	2	..
»	»	»	..	..	..	..	..	S 200	300	120	..	..	2	..
»	»	»	..	..	..	..	..	S 200	600	120	..	..	1	..
1284	6/4 22	3[00] a.m.	14°38′	61°16′	26°00	..	..	S 200	300	120	..	1	4	..
1285	7/4 22	3[15] a.m.	14°38′	61°16′	26°39	26°13	25°82	S 200	100	120	..	5	16	..
»	»	»	..	..	..	..	..	S 200	300	120	..	..	2	..
1289	15/4 22	0[40] a.m.	17°43′	64°56′	25°30	..	..	S 200	300	120	..	..	2	..
1291	15/4 22	7[30] p.m.	17°43′	64°56′	25°40	..	..	S 200	300	120	..	..	..	1
1293	17/4 22	7[40] p.m.	17°43′	64°56′	25°30	..	..	S 150	50	120	..	..	1	..
1294	18/4 22	7[30] p.m.	17°43′	64°56′	25°20	..	..	S 200	600	120	..	..	1	..
1296	19/4 22	8[15] p.m.	17°43′	64°56′	25°46	25°43	24°95	S 200	600	120	..	1	..	..
1352	21/6 22	9[30] p.m.	35°42′	73°43′	25°60	..	..	S 200	150	120	1	..	2	..

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REPORTS ON THE DANISH OCEANOGRAPHICAL EXPEDITIONS 1908—10
TO THE MEDITERRANEAN AND ADJACENT SEAS
Vol. II. Biology.

A. 14.

Carangidæ.

by

W. Schnakenbeck.

With 19 figures.

Published October 15., 1931.

EINHALTSVERZEICHNIS.

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EINLEITUNG.

Das vorliegende Material stammt zur Hauptsache von den Fahrten des »Thor« aus der Zeit von 1904—1910, daneben von Fängen verschiedener Handelsfahrzeuge aus den Jahren 1911—1913. Das Material ist also sehr alt, und dieser Umstand war vielfach recht hinderlich bei der Bearbeitung, da vieles in schlechtem Erhaltungszustand war. Am empfindlichsten für die Untersuchung machte sich das teilweise in sehr starkem Maße erfolgte Verblassen des Pigments bemerkbar, sodaß dieses sonst für die Unterscheidung verschiedener Jungfischlarven vielfach so wichtige Merkmal hier unzuverlässig war.

Der Formenreichtum des Materials war nur gering. Vielleicht mit einer Ausnahme gehörten alle Larven und Jungfische der Gattung *Caranx* an. Und hier stellt sich für die Bestimmung eine große Schwierigkeit in den Weg. Von dieser Gattung sind mehr als 80 Arten beschrieben. Die Unterschiede zwischen diesen Arten sind vielfach gering. In vielen Fällen liegen sie in erster Linie in der Zahl der Schilder auf der Seitenlinie. Die Zahl der Flossenstrahlen überschneidet sich bei vielen Arten erheblich in ihrer Variationsbreite. Die Wirbelzahl ist bei allen Arten gleich. Die in der Systematik vielfach zur Unterscheidung angeführten Körperproportionen gelten für erwachsene Fische. Somit ergeben sich also für die Bestimmung der Larvenformen, wobei in vielen Fällen, d. h. bei ganz jugendlichen Stadien, auch eine Zählung der Flossenstrahlen nicht durchführbar ist, sehr viele Schwierigkeiten, und sofern nicht volle Entwicklungsreihen bis zu größeren Stadien vorliegen, kann eine sichere Bestimmung nicht durchgeführt werden.

Es muß noch kurz erwähnt werden, daß in der Systematik der Carangiden viele Unklarheiten und Unstimmigkeiten zwischen den verschiedenen Autoren herrschen. Es ist hier nicht der Ort, auf systematische Streitfragen näher einzugehen, aber im Interesse der weiteren Ausführungen müssen doch einige kurze Erläuterungen gegeben werden, um Irrtümer zu vermeiden.

Wenn ich oben gesagt habe, daß fast alle im vorliegenden Material enthaltenen Entwicklungsstadien zur Gattung *Caranx* gehören, so muß ich hinzufügen, daß von manchen Autoren noch zwischen den Gattungen *Caranx* und *Trachurus* unterschieden wird, was hier nicht geschehen ist. Die größte Verwirrung herrscht aber in folgender Unterscheidung und Benennung.

Autor	*C. trachurus*	*C. trach. var. A sive vulgaris (Trach. Linnei)*	*C. trach. var. B sive mediterranea (Tr. mediterraneus)*	*C. Cuvieri*
Cuvier-Valenciennes[1]	70	80—88	94—99	—
Kröyer	70—80	80—88	94—99	—
Lütken	—	72—79	79—92	93—100
Smitt	73—75	—	79—92	93—108
Steindachner	—	70—75 (79)	79—86	93—108

[1] Cuvier und Valenciennes benennen die von ihnen nach der Schuppenzahl unterschiedenen Unterabteilungen nicht.

Nach der Zahl der Schilder auf der Seitenlinie sind die Formen *Caranx trachurus, C. trachurus var. A sive vulgaris, C. trachurus var. B sive mediterranea* und *C. Cuvieri* unterschieden. Hinzu kommen noch als Synonyma *Trachurus Linnei* und *Tr. mediterraneus.* Aber diesen Bezeichnungen entsprechen nach der Schuppenzahl nur drei Gruppen, und die Benennung ist durchaus uneinheitlich. Ich gebe vorstehend eine kurze Übersicht, lediglich um klarzustellen, welche Formen ich mit meinen später gewählten Bezeichnungen meine (s. S. 3).

Man kann also ganz deutlich nach der Zahl der Schilder die drei Gruppen 70—79, 79—92, 93—108 unterscheiden. Ohne hier eine endgültige Stellungnahme zu dieser Frage zu nehmen, will ich hier, lediglich um Mißverständnissen vorzubeugen, feststellen, daß ich in meinen weiteren Ausführungen unter *C. trachurus* die Gruppe mit 70—80 Schuppen verstehe, *C. mediterraneus* mit 79—92, *C. Cuvieri* mit 93—108.

Die Unterschiede zwischen diesen drei Gruppen, die teils als Arten, teils nur als Varietäten angesehen sind, liegen also in erster Linie, wenn nicht überhaupt allein, jedenfalls soweit bisher bekannt, in der Zahl der Schuppen. Ob auch in der Entwicklung sich Unterschiede bemerkbar machen, ist zunächst völlig unbekannt. Auch das vorliegende Material reicht nicht aus, um in dieser Beziehung eine Klärung zu bringen. Da aus einem Gebiet, in dem sicher nur *Caranx trachurus* vorkommt, nämlich der Nordsee, so viele Entwicklungsstadien in dem Material vorhanden sind, daß eine vollständige Entwicklungsreihe zusammengestellt werden kann, so ist damit ein gewisser Anhaltspunkt gegeben, insofern als alle davon abweichenden Entwicklungsstadien mit Sicherheit als anderen Formen zugehörig erkannt werden können, ohne daß man diese jedoch vorerst sicher identifizieren könnte. In dem hier vorliegenden Material sind immer nur einzelne Stadien, keine vollkommenen Reihen enthalten. Sie sind deshalb hier vorerst mit der Bezeichnung Typ A, B, C usw. belegt. Daß sich nicht alle Stadien von *C. trachurus* derselben Größe in Pigmentierung und Entwicklungsgrad aus Nordsee, Atlantik und Mittelmeer vollkommen gleichen, daß gewisse Schwankungen vorhanden sind, ist selbstverständlich. Wahrscheinlich handelt es sich nur um Schwankungen im Grad der inneren Differenzierung, wie man das auch bei anderen Fischen findet, besonders in einem Gebiet von so großer Ausdehnung wie hier.

DIE ENTWICKLUNGSFORMEN UND IHRE FUNDSTELLEN.

A. CARANX TRACHURUS.

Diese Art bildet die Hauptmenge des vorliegenden Materials, zumal hiervon ein sehr großer Teil aus nördlichen Gebieten, Nordsee, Kanal und vorgelagerten Gewässern des Atlantik, stammt, wo allein diese Art vorkommt. Aber auch weiter südlich, an den Küsten der Iberischen Halbinsel und im Mittelmeer zeigt sich diese Art in den vorliegenden Fängen vorherrschend, ja sogar im westlichen Nordatlantik und an der amerikanischen Küste ist diese Art anzutreffen. Im einzelnen sind die Fundorte in der Tabelle I angeführt.

Zu dem zuletzt genannten Vorkommen bedarf es noch einiger Worte. Bei Jordan und Gilbert (12) sowie bei Jordan und Evermann (11) ist *C. trachurus* für die atlantischen Gewässer Nordamerikas wohl angegeben, und zwar als *Trachurus saurus bezw. Tr. trachurus,* es wird aber gesagt, daß diese Art auf der amerikanischen Seite des Atlantik nur selten sei. Jedoch die zwei vorliegenden Jugendstadien, 19 bezw. 23 mm Länge, gefangen auf 38°45′ N 69°56′ W (Stat. 355/1911, SS »Pennsylvania«) vor der Küste von New Jersey, entsprechen nicht nur in ihrer Pigmentierung und Bedornung der Kiemendeckel, sondern auch in anderen Merkmalen den entsprechenden Stadien von *C. trachurus* aus den europäischen Gewässern. Die Proportionen gewisser Körperabschnitte sind ebenfalls gleich bei den Stadien aus beiden Gebieten. Die Flossenformeln lauten D. 8 $^{1}/_{31}$ bezw. 32, A. 2 $^{1}/_{27}$. Diese Zahlen fallen durchaus in die bei nordeuropäischen Individuen festgestellte Variationsbreite dieser Flossen. Bei Jordan und Evermann finden sich

Tab. I. Fundorte und Gröszen von *Caranx trachurus*.

Nordsee (einschl. Kattegat u. Skagerrak.)

Stat.	Datum	mm																																				
		3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	28	30	31	32	33	34	35	36	41	45
176	8/9 05	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
206	21/9 06	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	1	.	2	.	.	.	.	1	.	.	.
174	7/9 05	.	.	1	3	6	5	2	.	1	.	.	2	2	1	.	1	.	1	.	.	1	1	2	2	1	3	1	1	.	3	.	.	.	1
295	9/9 04	.	.	1	.	1	1	.	.	.	1	2	.	1	.	1	1	1	1	.	.	.	.	.	.	.	.	.	.	.	1	.	1	1	.
203	20/9 06	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.
150	14/8 06	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
153	15/8 06	.	.	.	.	.	.	.	1	2	1	1	2	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
147	18/8 06	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
155	17/8 06	.	.	.	.	.	.	2	.	2	3	6	.	3	.	2	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
156	18/8 06	.	.	2	.	4	4	1	2	1	1	.	.	.	1	2	.	.	.	.	.	2	1	.	.	.	.	.	.	.	.	.	.	.	.
157	18/8 06	.	.	.	.	.	.	.	.	1	.	1	1	2	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
102	1/7 05	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
103	1/7 05	.	.	7	7	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
158	18/8 06	.	.	23	17	11	5	4	6	1	3	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
202	17/9 06	.	1	1	.	1	.	2	1	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
202	18/9 06	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
201	16/9 06	.	.	1	.	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
160	19/8 06	.	3	40	36	16	15	6	6	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
200	16/9 06	.	.	.	.	1	1	.	1	.	.	4	.	1	.	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
100	30/6 05	1	13	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Kanal u. vorgelagertes Gebiet des Atlantik.

Stat.	Datum	mm																																				
		6	7	8	9	10	11	12	13	14	17	20	26	27	30	32	34	37	38	41	50	53	54	57	58	60	61	62	63	64	69	70	74	78
199	15/9 06	1	.	1	2	.	2	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
198	15/9 06	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
196	14/9 06	.	.	.	.	.	.	.	.	.	.	.	1	.	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1	28/11 08	.	2	.	1	1	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
195	13/9 06	1	.	2	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
3	30/11 08	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
193	12/9 06	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1	1
192	11/9 06	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	2	.	.
191	11/9 06	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.
187	9/9 06	.	.	.	1	.	.	.	.	.	1	.	1	.	1	1	2	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
177	1/9 06	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	1	2	7	2	6	2	2	.	.	.	.
170	29/8 06	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Atlantik (W. v. Gibraltar.)

Stat.	Datum	mm												
		4	5	6	7	8	9	10	11	12	13	14	15	16
85	17/6 10	.	.	.	2	1	.	3	1	.	.	.	1	.
88	17/6 10	.	.	1	1	1	2	1	.	.	2	.	.	.
69	28/2 09	.	.	.	.	.	.	.	.	.	.	.	.	1
229	8/9 10	1	.	.	.	.	.	.	.	.	.	.	.	.

Mittelmeer (Gibraltar bis Balearen).

Stat.	Datum	mm																				
		2	3	4	5	6	7	8	9	10	11	12	13	17	18	19	20	21	22	24	27	28
99	24/6 10	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..
228	7/9 10	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
59	21/2 09	..	2	3	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
227	6/9 10	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
58	20/2 09	..	..	..	1	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
57	30/2 09	..	..	3	2	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
225	6/9 10	..	..	..	..	1	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
104	24/6 10	..	..	..	1	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..
106	25/6 10	3	5	9	3	2	..	1	1	2	..	..	1	..	..	..	..	..	..	..	..	..
107	25/6 10	..	..	..	..	..	1	..	1	1	1	..	..	..	..	..	..	..	..	..	..	..
52	18/2 09	..	..	..	4	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
108	25/6 10	..	..	1	..	1	1	2	1	1	..	1	..	..	..	..	..	..	..	..	..	..
218	3/9 10	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
113	28/6 10	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
531	9/8 12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..
758	11/11 13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	1	..
213	31/8 10	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..
208	29/8 10	..	..	..	..	2	1	..	..	..	..	..	..	..	2	..	..	..	..	..	..	..
209	29/8 10	..	..	..	1	..	..	..	..	..	..	..	..	..	..	1	..	1	1	..	..	1
210	30/8 10	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..

Mittelmeer (Korsika-Sardinien bis Sizilien).

Stat.	Datum	mm																								
		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	22	25	27	28	29	31	32	59	67
124	3/7 10	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1
123	3/7 10	..	1	1	2	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..
126	10/7 10	1	1	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
45	6/2 09	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..
136	19/7 10	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
132	14/7 10	1	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
200	26/8 10	..	..	..	..	..	..	..	1	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..
130	13/7 10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..
Cap Faro	20-28/8 11	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	1	1	..	..	..	1	1	1	..	..
193	21/8 10	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
192	20/8 10	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
718	17/5 13	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	1	..	..	..	..	..	..	..

Mittelmeer (Griechenland bis Kreta).

Stat.	Datum	mm
		28
340	26/8 11	1

Ägäisches Meer.

Stat.	Datum	mm			
		6	13	14	38
163	3/8 10	1	..	..	..
182	14/8 10	..	1	..	..
183	16/8 10	..	1	1	1

Dardanellen bis Bosporus.

Stat.	Datum	mm						
		4	5	6	7	61	70	71
178	12/8 10	..	..	..	1	..	..	..
176	12/8 10	..	..	1	..	..	..	..
174	10/8 10	..	..	..	..	1	1	1

Westatlantik.

Stat.	Datum	mm
		10
440	19/11 11	1

Ostatlantik.

Stat.	Datum	mm	
		10	15
361	5/4 11	1	..
364	6/4 11	..	1

Amerik. Küste.

Stat.	Datum	mm
		23
355	9/10 11	1

für die bisher bekannten amerikanischen Exemplare die Zahlen D. 8 1/39, A. 2 1/28, die ebenfalls in die Variationsbreite der europäischen Tiere fallen. Es kann somit wohl nicht an der Identität gezweifelt werden.

Das Gleiche kann für das 10 mm lange Stadium aus dem Westatlantik (Stat. 440/1911, „Ingolf", 18°45′ N 62°20′ W) gesagt werden.

Als Grundlage für die Untersuchung über die Entwicklung von *Caranx trachurus* ist hier, wie erwähnt, das Material aus der Nordsee verwandt, weil dieses mit Sicherheit als zu dieser Art gehörig angesehen werden kann.

Ich halte es für zweckmäßig, besonders im Hinblick auf spätere Untersuchungen und die dadurch vielleicht notwendig werdenden Vergleiche, hier einige an dem Nordseematerial gewonnene Proportionszahlen, Höhe und Kopflänge zur Gesamtlänge, anzugeben. Da einerseits bei solchen Messungen Fehler unvermeidlich sind, andererseits auch gewisse natürliche Schwankungen vorhanden sind, habe ich in der Zusammenstellung (Tab. II) nicht für jede Größe die Proportionszahlen angeführt, sondern für einzelne Größengruppen, und dafür auch noch die Mittelzahlen. So werden Schwankungen und Unregelmäßigkeiten ausgeglichen.

Tabelle II. Mittlere Körpermasze (mittlere Indices) bei *Caranx trachurus* (Nordsee) in verschiedenen Grösszengruppen.

Gesamtlänge	Mittl. Länge	Größte Höhe	Kopflänge
7—10	9.1	2.9	2.9
11—15	12.5	3.5	4.0
16—20	17.2	4.6	5.6
21—25	23.2	5.6	6.8
27—30	28.3	6.6	9.3
31—35	32.8	7.6	10.0
36—40	38.0	8.6	11.0
41—45	42.8	9.5	12.5
46—47	46.3	10.3	13.0
55	55.0	11.0	15.5
58—60	59.3	12.2	16.2
61—65	62.4	12.6	17.1
66—70	67.6	13.4	18.8
72—75	74.0	14.3	20.7
76—80	77.8	16.0	21.0
82—85	83.8	16.6	22.5
87—89	88.0	16.6	23.3
92—95	93.9	17.7	24.2
97	97.0	18.0	25.5
117—120	118.7	23.0	30.0
122—125	123.7	24.7	31.5
129—130	129.5	26.0	32.0
320	320.0	60.0	80.0

Die kleinsten in dem vorliegenden Material enthaltenen Larven (etwa 3,5 mm) sind mäßig gestreckt. Die größte Höhe liegt sehr weit vorn, am Kopf, und bleibt auch während der weiteren Entwicklung etwa an dieser Körperstelle. Darm und Schwimmblase sind wohl entwickelt. Diese zeigt etwa ovale

Form. Die Kiemendeckel sind bedornt, die Kiefer schwach bezahnt. Die Mesenchymwucherung unter dem Urostyl hat begonnen.

Die Entwicklung der äußeren Körperform (Abb. I) wird dadurch bestimmt, daß im Ver-

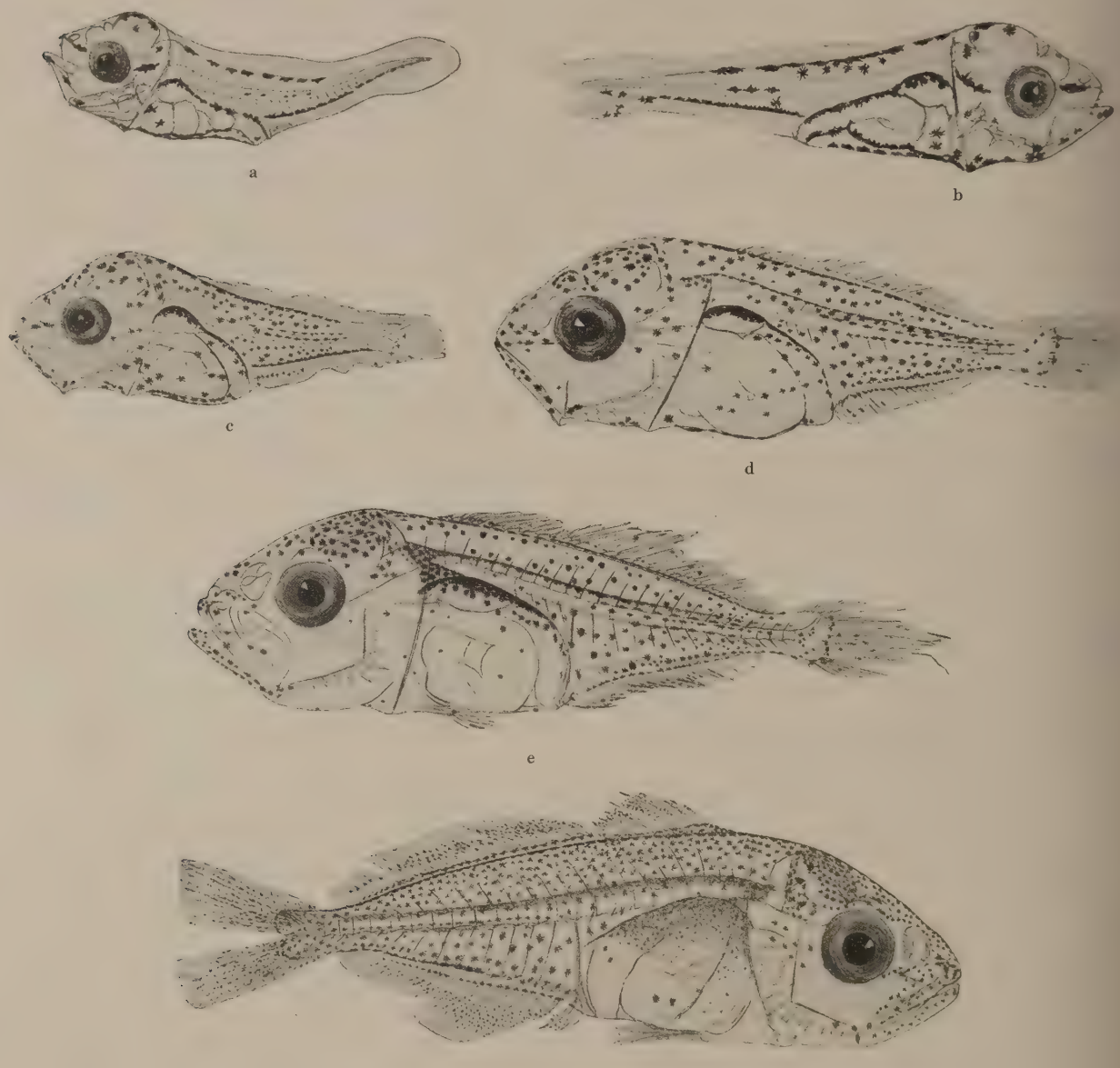


Abb. 1. *Caranx trachurus* (Nordsee); a 3.5, b 5, c 6.5, d 10, e 14, f 19.5 mm.

hältnis zur Zunahme der Körperhöhe und Körpermasse des Vorderteiles das Längenwachstum nur gering ist. Dadurch bekommen die Larven bald eine gedrungene Gestalt mit stark entwickeltem Kopf und Rumpf und mit verhältnismäßig kurzem Schwanzteil. Der Darm, bei den 3—5 mm langen Larven noch ziemlich gestreckt, sodaß der Eingeweidesack etwa ein langes, nach hinten gestrecktes spitzes Dreieck bildet, entwickelt sich sehr stark, der Eingeweidesack dehnt sich auch mehr in die Höhe als in die Länge aus

und bekommt allmählich eine fast rechteckige Form. Hinter dem Enddarm ist die große Harnblase deutlich sichtbar. Schon bei einer Länge um 10 mm ist die endgültige Caranx-Gestalt in großen Zügen erkennbar und bei 15—20 mm als vollkommen ausgebildet anzusehen.

Auch vom Innenskelett sind bereits bei geringer Körpergröße einzelne Teile wohl ausgebildet und verknöchert. Der Schultergürtel ist schon bei 3,5 mm angelegt. Die Wirbelsäule läßt ihre erste Gliederung und Ausbildung der Dornfortsätze bereits bei einer Länge um etwa 7—8 mm erkennen. Die Gliederung, Ausbildung der Dornfortsätze und die Verknöcherung beginnt am kaudalen Ende und schreitet dann allmählich kranialwärts fort. Die Schwanzplatte selbst bleibt allerdings zunächst noch unverknöchert.

Die Pigmentierung ist bei 3—4 mm langen Larven zur Hauptsache in drei Längslinien angeordnet, wovon eine am Dorsalrand der Körpermuskulatur entlangläuft, die zweite am oberen Rande des Eingeweidesackes mit einer Fortsetzung am Ventralrand der Muskulatur, die dritte an der Bauchkante. Die obere Pigmentlinie besteht aus getrennt liegenden Pigmentzellen von zunächst geringerer Zahl, sie beginnt über den vorderen Myomeren, hält aber in der Mitte des Abschnittes zwischen After und Schwanzende auf. Die mittlere Linie besteht in ihrem vorderen Teil aus den regellos am Dach des Eingeweidesackes verteilten Melanophoren, im hinteren Teil aus reihenartig angeordneten Zellen, die aber dichter liegen als am dorsalen Rand der Muskulatur. Diese ventrale Reihe reicht wesentlich weiter kaudalwärts als die dorsale, wird aber am Ende, im Ausbildungsgebiet der Schwanzplatte, lockerer. Die untere Zone zieht sich über die ganze Unterseite des Eingeweidesackes hin. Gewissermaßen als Fortsetzung dieser drei Linien nach vorne ist am Kopf das Pigment über dem Gehirn, vor und hinter dem Auge und an der Unterseite, vom unteren Ende des Schultergürtels bis zum vorderen Rand des Unterkiefers anzusehen. Eine weitere Längsreihe zeigt sich bereits bei 3,5 mm langen Larven in ihrer ersten Anlage durch einzelne Chromatophoren. Diese liegen in der medianen Seitenlinie, sind längsgestreckt und haben unregelmäßige Zwischenräume.

Die Vermehrung des Pigmentes erfolgt nun zunächst auf den Seiten der Myomeren (um 5 mm), und zwar etwa auf dem mittleren Teil des Körpers. Die Pigmentierung geht dabei dorsal der ventralen etwas voraus; von den unter dem Urostyl liegenden Melanophoren werden durch die hier erfolgende Mesenchymwucherung einzelne weiter in den Schwanzflossensaum hineingeschoben. Sonst ändert sich zunächst im Prinzip nichts an der Pigmentierung.

Im Laufe der weiteren Entwicklung (um 6 mm) treten zwei weitere Pigmentlinien zu den bisherigen hinzu, eine über dem Neuralrohr, eine an der Basis der Afterflossenstrahlen. Die erste Reihe legt sich zuerst in dem Körperabschnitt an, in dem sich auch die Medianreihe zuerst bildet, und dehnt sich dann nach vorn aus; die zweite erscheint zuerst im vorderen Teil der Flosse und dehnt sich dann kaudalwärts weiter aus. Die übrige Pigmentierung hat sich verstärkt, besonders die an den Körperseiten und über dem Gehirn. Die seitliche Körperpigmentierung dehnt sich zur Hauptsache in einer gürtelartigen Zone quer über den postanalen Körperabschnitt aus, läßt aber dabei eine Zone am Schwanzende frei bis auf die ventrale bezw. hypurale Pigmentreihe. Nach vorne dehnt sich das Pigment nur dorsal bis zum Kopf aus. Auf dem Eingeweidesack erscheinen auch seitlich verstreut liegende Melanophoren.

An allen Körperstellen kommt die weitere Entwicklung der Pigmentierung zur Hauptsache in der Vermehrung zum Ausdruck. Neu hinzu tritt eine Chromatophorenreihe unmittelbar über der Wirbelsäule und später eine zweite unmittelbar unter der Wirbelsäule. Beide Reihen treten ebenfalls in der Gegend zuerst auf, in der sich auch die mediane wie die epineurale Reihe zuerst gebildet haben. Auch auf Rücken- und Afterflosse beginnt sich Pigment zu entwickeln. Am Schwanzende, zwischen dem Ende von Dorsal- und Analflosse einerseits und der Schwanzplatte andererseits, ist bei einer Länge um 10 mm eine pigmentfrei Zone immer noch deutlich sichtbar. Sie verschwindet erst allmählich, wenn sich das Oberflächenpigment bis auf diese Körpergegend ausgedehnt hat (etwa zwischen 15 und 16 mm).

An der Basis der Rückenflossenstrahlen bildet sich auch eine Pigmentreihe, wie bei der Afterflosse, aber wesentlich später als bei dieser (um 14 mm). Auf den Flossen beginnt das Pigment sich jetzt eben-

falls stärker zu entwickeln, auf der Schwanzflosse in unregelmäßiger Lagerung, an der D. I auf den distalen Teil beschränkt, an D II und A. in einer kaudalwärts spitz zulaufenden Zone, die sich etwa über die Mitte der Flossen hinzieht. Das Oberflächenpigment bildet nun auch dorsal mehr, aber kleinere Zellen als ventral.

Die Bedornung der Kiemendeckel (Abb. 2) zeigt eine nicht ganz unerhebliche Variabilität bei gleich großen Individuen. nicht nur in Form und Größe, sondern auch in Zahl der Dornen (Abb.

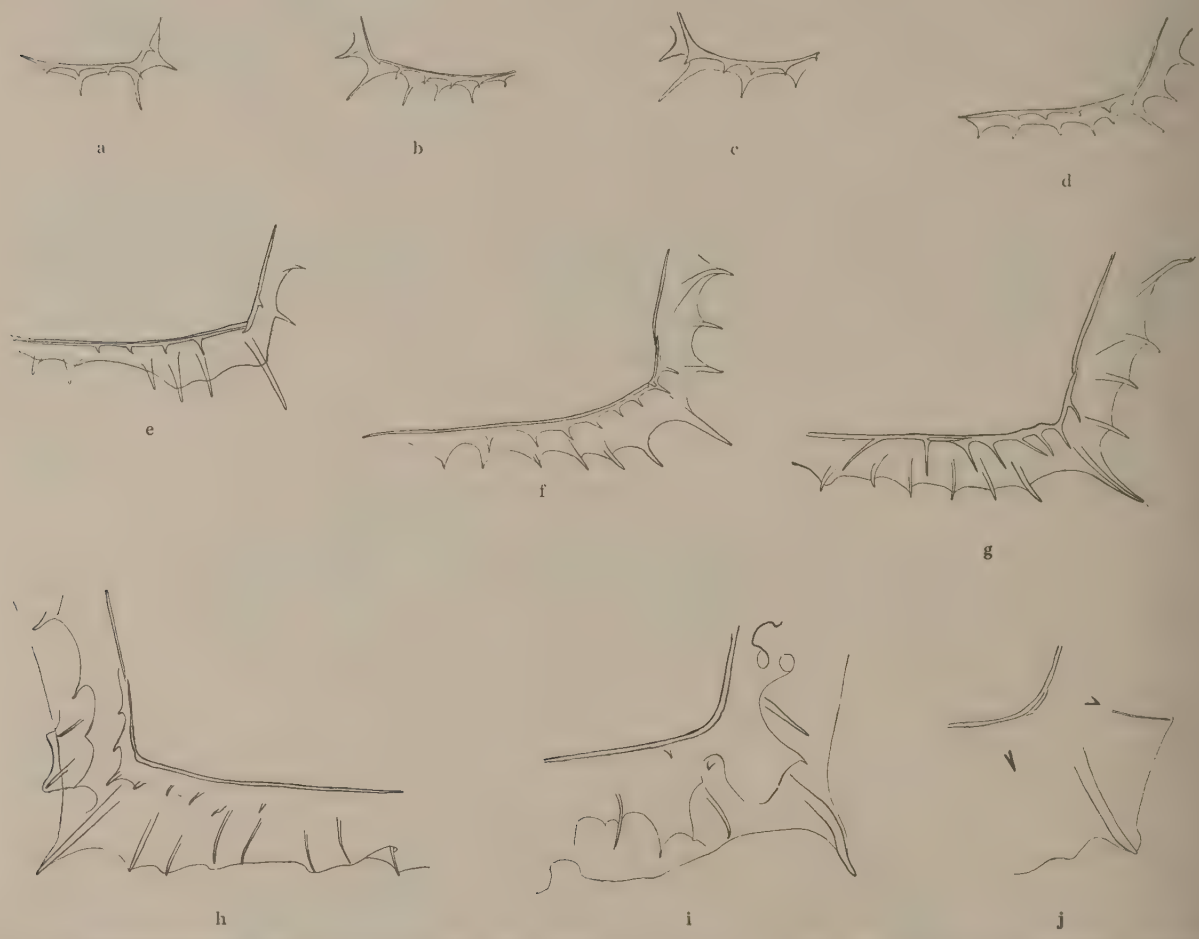


Abb. 2. Kiemendeckel-Bedornung von Caranx trachurus (Nordsee); a und b 3.5, c 5, d und e 6.5, f 10, g 14, h 19.5, i 26.5, j 34.5 mm.

2a—c, d und e). Wir finden bei *C. trachurus* zwei Reihen Dornen, eine am Hinterrand des Präoperkulums, das sind die größeren und stärkeren, und eine davor auf der Crista, diese sind kürzer. Die Grundanordnung der Dornen ist folgende: An der hinteren Ecke des Präoperkulums sitzt ein Eckdorn, der der längste und kräftigste ist. An dem nach oben verlaufenden Rand kann die Zahl der Dornen bis zu vier betragen, an dem unteren, horizontal verlaufenden Rand ist die Zahl der Dornen größer, bis zu sieben. Auf der Crista ist der Eckdorn nicht immer der größte, im algemeinen sind diese Dornen sich in der Größe untereinander ziemlich gleich. Die Crista ist im allgemeinen nur an ihrem horizontalen Ast bedornt, zur zuweilen sitzen über dem Eckdorn ein, seltener zwei Dornen.

Die Ungleichheit in der Zahl der Dornen bei verschiedenen Tieren gleicher Größe geht aus Abb. 2a und b hervor, und daß die Zahl der Dornen bei kleineren Larven zuweilen größer sein kann als bei

größeren Larven zeigt der Vergleich zwischen Abb. 2b und c. Dessenungeachtet kann man aber doch als Allgemeinregel gelten lassen, daß größere Larven eine größere Zahl von Dornen am Präoperkulum haben,

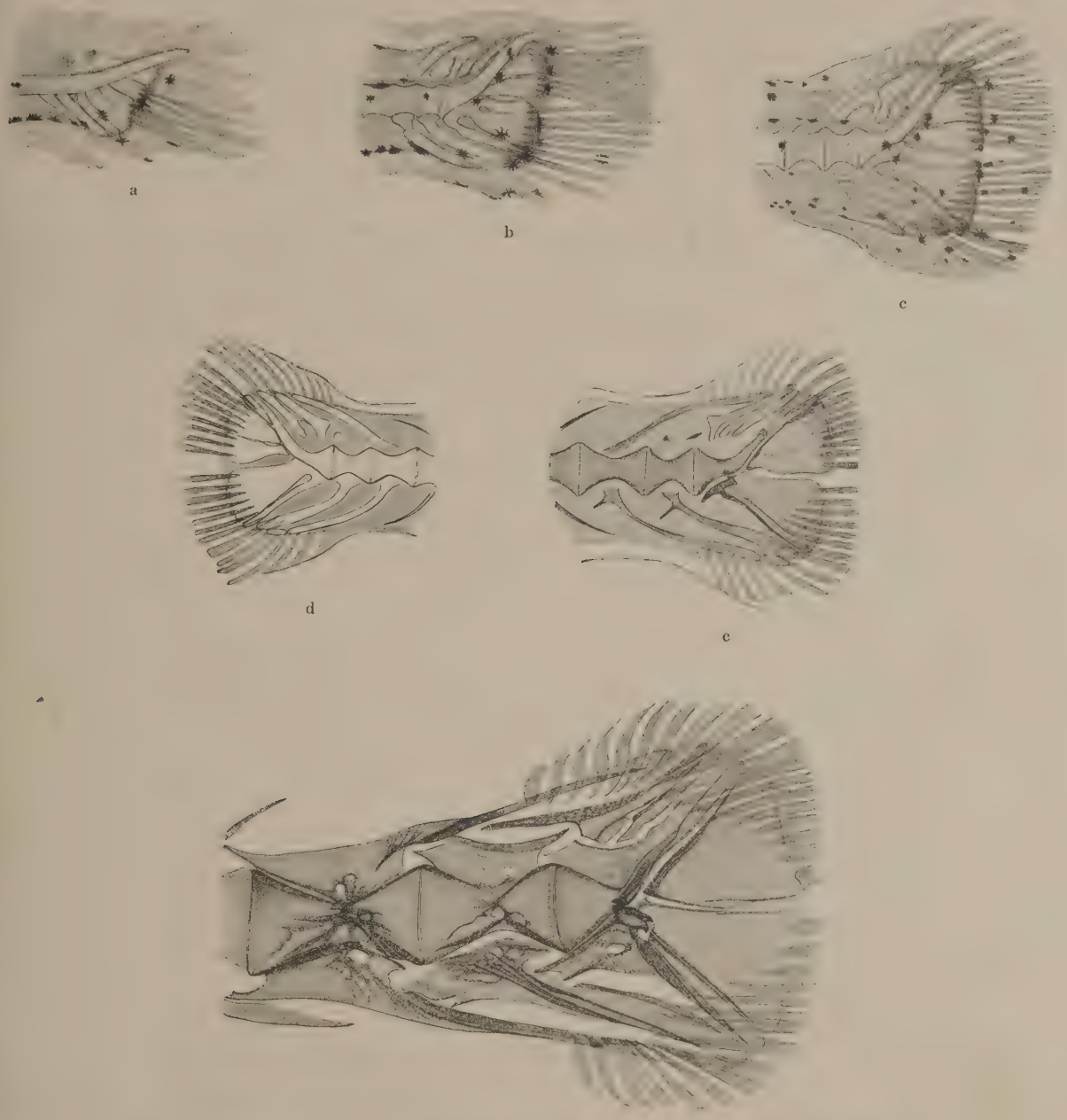


Abb. 3. Schwanzflosse von Caranx trachurus (Nordsee): a 6.5, b 10, c 14, d 19.5, e 26, f 70 mm.

wobei die Zunahme der Dornenzahl vom Eckdorn aus nach oben wie nach vorne fortschreitet. Diese Zunahme geht aber nur bis zu einem gewissen Stadium. Eine bestimmte Grenze kann hierfür nicht angegeben werden, die individuellen Unterschiede mögen nicht unerheblich sein, aber bei einer Größe um 10 mm mag ungefähr diese Grenze liegen. Dann erfolgt in der Hauptsache ein Größenwachstum der ein-

zelnen Dornen, sie werden vor allen Dingen spitzer und länger. Wann dieses Wachstum aufhört, ist schwer zu sagen. Es setzt dann bald eine Degeneration der Dornen ein, für die man als Beginn etwa das Stadium angeben könnte, in dem die Fischchen eine Länge von 15 bis 20 mm erreicht haben. Die Dornen erscheinen dann dünner und zeigen vielfach Krümmungen. Wie die Ausbildung von der Ecke nach oben bezw. vorn fortschreitet, so geht die Degeneration den umgekehrten Weg, sie beginnt vorn bezw. oben und schreitet nach der Ecke zu fort. Der Eckdorn bleibt so als letzter am längsten erhalten.

Von einigem Interesse und vielleicht auch von einer gewissen diagnostischen Bedeutung dürfte die Entwicklung und der Bau der Schwanzplatte sein (Abb. 3). Der Grad der Differenzierung im Verhältnis zur Größe des Individuums scheint auch hier gewissen Schwankungen unterworfen zu sein, wie es auch von vielen anderen Fischen her bekannt ist.

Aus der hypuralen Mesemchymwucherung bilden sich zunächst vier Hypuralia heraus, von denen eins, das unterste, lang und schmal, drei dagegen kurz und breit sind. Bald bildet sich aber ganz oben, unmittelbar unter dem Ende des Urostyls, noch ein weiteres, ganz schmales keilförmiges Hypurale. Damit ist die Grundlage ausgebildet. Das 4. Hypurale (von oben gerechnet) zeigt aber von vornherein durch eine deutliche Furche und durch ein kleines längliches Loch nahe der Basis, daß es eigentlich aus zwei Hypuralia besteht, die garnicht mehr gesondert zur Ausbildung kommen, sondern schon während ihrer Entwicklung partiell miteinander verschmelzen. Die vollkommene Verschmelzung erfolgt erst später bei der Verknöcherung. Bei einer Länge um 19 mm ist aber das 4. Hypurale durchaus einheitlich (Abb. 3d).

Mit dem 5. Hypurale besteht an der Basis ebenfalls eine Verbindung, aber es kommt hier nicht zur vollen Verschmelzung. Aber ein solcher Vorgang erfolgt beim 2. und 3. Hypurale. Zunächst am distalen Ende, dann auch am basalen Teil legen sich die Ränder der beiden Hypuralia dicht aneinander (Abb. 3d), und mit der Verknöcherung geht eine Verschmelzung vor sich. Auch hier bleibt, wie beim 4. Hypurale, zunächst nahe der Basis noch ein Loch mit einer nach dem Rande zu verlaufenden Furche bestehen. Aber auch diese verschwindet schließlich, sodaß später ein vollkommen einheitliches Hypurale vorhanden ist.

Damit sind aber die im Schwanzflossenskelett vor sich gehenden Verschmelzungen noch nicht beendet. Die epuralen Mesenchymwucherungen treten später ein als die hypuralen. Bei der Ausbildung der Epuralia macht sich zuerst eine Vorwölbung am dorsalen Schwanzrande besonders bemerkbar (Abb. 3a), die durch das Wachstum des (vom Urostyl aus gerechnet) 3. Epurale verursacht wird. Das 2. Epurale bleibt zunächst ganz kurz, es liegt zwischen dem 1. und 3. Epurale wie eingeklemmt.

Wie die Ausbildung der Epuralia später begonnen hat als die der Hypuralia, so bleibt auch ihre weitere Entwicklung merklich hinter diesen zurück. Noch bei einer Länge von 26 mm und mehr ist die Ausbildung der Epuralia, abgesehen vom Längenwachstum, nicht viel anders, als sie bei 10—14 mm Länge gewesen ist. Um 25 mm Länge setzt dann schon allmählich eine Verschmelzung des 1. Hypurale mit dem Urostyl ein, und später erfolgt dann mit diesem Verschmelzungsprodukt eine Vereinigung des 1. Epurale. Das 2. Epurale, von Anfang an klein, kommt auch späterhin nur zu einer geringen Entwicklung, es wächst nur in die Länge. Die weit kaudalwärts ausgezogenen oberen und unteren Dornfortsätze des drittletzten Wirbels sowie der untere Dornfortsatz des zweitletzten Wirbels werden ebenfalls mit in das Schwanzflossenskelett einbezogen.

Die Zahl der Schwanzflossenstrahlen ist, wie bei anderen Fischen, so auch bei C. trachurus recht regelmäßig, nicht nur in der Gesamtzahl, sondern auch in ihrer Beziehung zu den einzelnen Skeletelementen der Schwanzplatte, jedenfalls soweit es die Hauptstrahlen betrifft. Es läßt sich so eine Schwanzflossenformel aufstellen, wobei, dorsal beginnend, jeweils die Zahl der Strahlen angegeben wird, die mit ihrer Basis einem Hypurale ansitzen. Für *C. trachurus* lautet diese Schwanzformel: $1+(5+3)+6+1$. Die an die Epuralia und an die unteren Dornfortsätze des zweit- und drittletzten Wirbels ansetzenden Strahlen sind als Nebenstrahlen nicht mit berücksichtigt. Die Klammer bedeutet, dass die von ihr eingeschlossenen beiden Strahlenzahlen nur zuerst zwei getrennten Hypuralia zugehören, später aber zusammen einem gemeinsamen Hypurale.

Die übrigen unpaaren Flossen zeigen sich in ihrer ersten Anlage, d. h. als beginnende Mesenchymwucherungen, bei einer Länge um etwa 5 mm. Bei Rücken- und Afterflosse eilen die mittleren Teile in der Entwicklung vorauf, aber bei der Afterflosse ist die Entwicklung im vorderen Teil deutlich früher abgeschlossen als im hinteren Teil. In der Rückenflosse ist kaum ein Unterschied in dieser Beziehung wahrnehmbar.

Die Bauchflossen sind noch bei einer Länge von 7—8 mm als erste Keimanlage unter der Bauchkante verborgen, selbst bei 10 mm Länge ist die Entwicklung noch ganz gering, erst dann geht sie etwas schneller vor sich.

B. ANDERE FORMEN.

Die übrigen in dem vorliegenden Material vorhandenen Formen sind mit volkommener Sicherheit vorläufig nicht zu identifizieren, da das Material zu lückenhaft ist, besonders im Hinblick auf die geringen Unterscheidungsmöglichkeiten. Die von den Entwicklungsstadien von C. trachurus abweichenden Formen werden hier deshalb vorläufig als Typ A, B usw. bezeichnet.

Einzelne Jungfische konnten allerdings auch bestimmt werden, aber nur solche, bei denen die Schuppen auf der Seitenlinie bereits zu zählen waren. Das ist erst bei verhältnismässig großen Jungfischen der Fall, und irgend welche sonstigen Abweichungen gegenüber *C. trachurus* ließ sich bei diesen Formen nicht erkennen.

Caranx mediterraneus: Wie ich in der Einleitung angedeutet habe, bezeichne ich mit diesem Namen die Art mit 79—92 Schildern auf der Seitenlinie. Ihre Verteilung auf die Fangorte ist folgende:

Stat. 123		$^{3}/_{7}$ 1910	27 mm Mittelmeer zwischen Korsika und Sardinien.
— 142	(»Pangan«)	$^{22}/_{7}$ 1910	28 mm Mittelmeer zwischen Korsika und Sardinien.
— 340	—	$^{26}/_{8}$ 1911	28 mm Mittelmeer zwischen Griechenland und Kreta.

Die Flossenformel für diese drei Exemplare lautet: D. I 8, D. II $^{1}/_{31-34}$, A. 2 $^{1}/_{27-32}$.

Caranx Cuvieri: Von dieser Art konnten mit Sicherheit nur zwei Exemplare in dem vorliegenden Material festgestellt werden. Sie stammen aus dem offenen Atlantik, nordwestlich von Madeira.

Stat. 290	(»St. Croix«)	$^{12}/_{5}$ 1911	36 mm.
— 325	(»St. Jan«)	$^{7}/_{6}$ 1911	71 mm.

Die Flossenformel lautet: D. I 8, D. II $^{1}/_{33}$, A. 2 $^{1}/_{27-30}$. Ein Vergleich mit C. mediterraneus zeigt, daß die Zahl der Flossenstrahlen keine Unterscheidungsmöglichkeit zwischen diesen beiden Arten bietet. Auch gegenüber C. trachurus ist eine Unterscheidung in diesen Merkmalen nicht durchzuführen.

Typ A (Abb. 4—6): Die Fundorte dieses Typs liegen zur Hauptsache im westlichen Mittelmeer, im Gebiet zwischen Gibraltar und den Balearen (Stat. 207 und 227), ein Exemplar aus dem Ostatlantik zwischen den Kanarischen und Kapverdischen Inseln (Stat. 527).

Stat. 207		$^{28}/_{8}$ 1910	5 mm.
— 227		$^{6}/_{9}$ 1910	6, 9, 12 mm je 1 Stück, 11 mm 3 Stück.
— 527	(»Texas«)	$^{3}/_{8}$ 1912	6 mm.

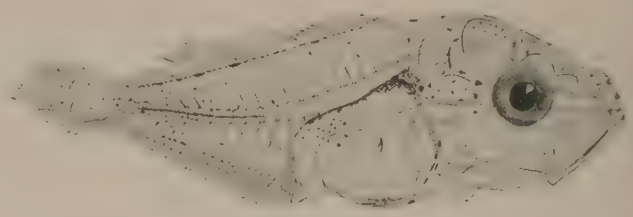
Soweit bei diesen Jungfischen die Strahlen in der ganzen Länge der Rücken- und Afterflosse schon angelegt waren, konnte folgende Formel festgestellt werden: D. I 8, D. II $^{1}/_{29-31}$, A. 2 $^{1}/_{26-27}$. Eine Möglichkeit zur Identifizierung dieser Fischchen bietet diese Flossenformel nicht. Eine Zusammengehörigkeit der hier verzeichneten kleineren und größeren Entwicklungsstadien leite ich von gewissen Ähnlichkeiten in der Pigmentierung ab.

Die Unterschiede gegenüber *C. trachurus* sind ganz augenfällig. Sie beruhen in erster Linie auf der Pigmentierung, der Körperform und dem Grad der Differenzierung im Verhältnis zur Größe.

Das jüngere Stadium (Abb. 4a) entspricht in seiner Länge (5 mm) dem in Abb. 1b wiedergegebenen Stadium von C. trachurus. Die wesentlich gedrungenere Gestalt der Larve vom Typ A fällt sofort in die Augen. Der Kopf und der gesamte Vorderkörper sind höher, auch der Eingeweidesack ist kürzer und gedrungener, er hat mehr die Form eines gleichseitigen Dreiecks. Auch bei den größeren Stadien (um 10 mm) ist noch der gleiche Unterschied vorhanden (Abb. 4b und 1d), nur der Eingeweidesack erscheint nun beim Typ A etwas größer.

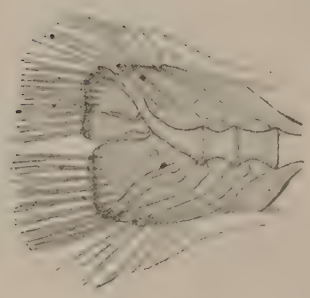
Vielleicht noch auffallender ist der Unterschied in der Pigmentierung. Diese ist beim Typ A ganz wesentlich geringer als bei C. trachurus. Drei horizontale Pigmentreihen sind auch beim Typ A vor-

4a

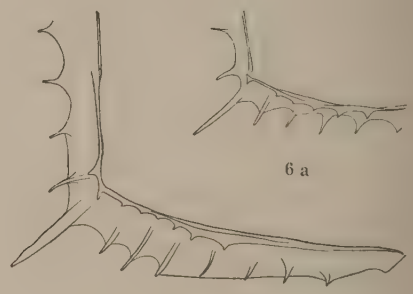


4b

5a



5b



6a

6b

Abb. 4 Typ A (westl. Mittelmeer); a 5, b 10.5 mm.
- 5 - A (— —), Schwanzflosse; a 5, b 10.5 mm.
- 6 - A (— —), Kiemendeckel-Bedornung; a 5, b 10.5 mm.

handen, die dorsale, mediane und ventro-viszerale. An der Unterseite des Eingeweidesackes fehlen dagegen die Melanophoren. Im vorderen ventralen Körperabschnitt liegt nur eine Pigmentzelle vor der Knospe der Bauchflossen. In den genannten Pigmentreihen liegen aber die Zellen viel lockerer, und auch bei den größeren Stadien bleibt die Pigmententwicklung noch wesentlich hinter der von *C. trachurus* zurück (Abb. 4b und 1d).

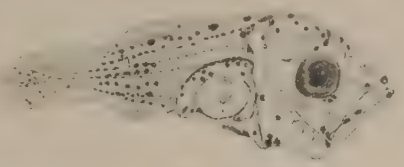
In der Dorsallinie liegt eine Anzahl, zunächst etwa drei, Zellen etwa in der Mitte des postanalen Körperabschnittes dichter zusammen. In großem Abstand davor liegt eine einzelne Pigmentzelle etwa am Anfang der zweiten Rückenflosse, eine weitere eben hinter dem Kopf und schließlich eine über dem Großhirn. Unter der hinteren dorsalen Zellgruppe liegt eine ähnliche Gruppe in der Medianlinie und darunter eine am ventralen Rand. Damit ist auch beim Typ A die gleiche gürtelartige Pigmentzone angedeutet, die bei *C. trachurus* vorhanden ist. Über dem Eingeweidesack ist die Pigmentablagerung ebenfalls geringer als bei *C. trachurus*, daß sie an der Ventralseite vollkommen fehlt, wurde bereits angedeutet.

Der sehr starken Pigmententwicklung zwischen 5 und 10 mm bei *C. trachurus* steht nur eine ganz geringe Weiterentwicklung des Pigments beim Typ A gegenüber. In erster Linie ist diese Entwicklung in

der gürtelartigen Zone des postanalen Körperabschnittes erfolgt, und zwar durch Verlängerung der Medianreihe und Ventralreihe, Bildung von Pigment auf den Körperseiten und der Analflosse dieser Zone. In der Dorsalreihe sind die ursprünglichen Zwischenräume zwischen den verstreut liegenden Zellen aufgefüllt, aber die zuerst vorhandenen Zellen heben sich durch ihre Grösse immer noch besonders hervor. Über dem Gehirn und in der Schwanzflosse hat sich die Zahl der Chromatophoren auch etwas vermehrt. Dasselbe ist in etwas stärkerem Maße am Eingeweidesack der Fall, wo über der Schwimmblase, eben über der Biegungsstelle des Enddarms und vor der Leber Zonen stärkerer Pigmentierung sich hervorheben.

Bereits bei einer Länge von 5 mm zeigt sich eine weitgehende innere Differenzierung. Die Wirbel beginnen sich bereits abzugliedern, die Dornfortsätze sind zum größten Teil schon sichtbar,

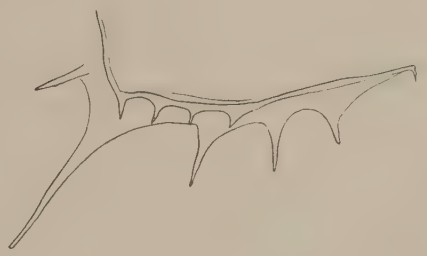
7a



7b

8

9a



9b

Abb. 7 Typ B (westl. Mittelmeer); a 4, b 5 mm.
- 8 - B (- —); 5 mm, Schwanzflosse.
- 9 - B (- —); Kiemendeckel-Bedornung; a 4, b 5 mm.

Dorsal- und Analflosse zeigen die erste Anlage, die Knospe der Bauchflossen ist deutlich erkennbar. Auch bei 10 mm Länge ist die gegenüber C. trachurus weiter fortgeschrittene Differenzierung nicht unerheblich.

Die Anlage der Schwanzflosse (Abb. 5) ist bereits bei 5 mm Länge ziemlich weit entwickelt, während bei C. trachurus in dieser Größe nur Mesenchymwucherungen sichtbar sind. In der Anlage selbst sind aber weder in diesem noch im größeren Stadium grundsätzliche Unterschiede vorhanden.

Wie bei *C. trachurus* werden auch beim Typ A fünf Hypuralia angelegt, von denen das 4. und 5. an der Basis miteinander verbunden sind und das 4. durch eine Furche und später durch ein Loch die ursprünglich zwei Bestandteile erkennen läßt. Auch eine Verschmelzung des 2. und 3. Hypurale erfolgt hier, nur wesentlich früher, sie beginnt bereits bei einer Länge um 10 mm (Abb. 5 b), während das bei *C. trachurus* erst um 19—20 mm der Fall ist. Zahl und Form der Epuralia ist auch ebenso. Die Schwanzformel entspricht genau der von *C. trachurus*.

In der Bedornung des Präoperkulums (Abb. 6) ist ein grundsätzlicher Unterschied ebenfalls nicht vorhanden. Auch die Zahl der Dornen ist beim Typ A durchschnittlich dieselbe wie bei *C. trachurus*.

Typ B. (Abb. 7—9): Die Fundorte dieses Typs beschränken sich auf das Gebiet vor dem Golf von Genua:

Stat.	122	$^{3}/_{7}$	1910	4	mm	2	Stck.
-	-	-	—	5	-	2	-
-	-	-	—	6	-	5	-
-	123	$^{3}/_{7}$	1910	5	-	3	-
-	-	-	—	6	-	2	-
-	-	-	—	7	-	1	-

Der Typ B weist sowohl mit Typ A wie mit *C. trachurus* gewisse Ähnlichkeiten auf. Mit C. trachurus hat er vor allen Dingen die stärkere Pigmentierung gemeinsam, doch ist bei dieser abweichend, daß bei Typ B in der Dorsallinie sich drei besonders große Chromatophoren hervorheben, an der Ventrallinie eine. Diese Zellen entsprechen in ihrer Lage derjenigen der einzeln liegenden Chromatophoren bei Typ A (Abb. 7a und 4a). Die Ähnlichkeit mit Typ A liegt vor allen Dingen in der hohen gedrungenen Körperform und der im Verhältnis zur Länge weit fortgeschrittenen Differenzierung.

Die Pigmentierung ordnet sich bereits bei einer Länge von 4 mm in acht Längsreihen an, und zwar am dorsalen Myomerenrand, über dem Neuralrohr, über der Wirbelsäule, in der seitlichen Medianlinie, unter der Wirbelsäule, zwischen den unteren Dornfortsätzen, am ventralen Myomerenrand und am distalen Rand der postanalen Flossenträger-Anlagen. Alle diese Reihen verlängern sich sehr schnell, besonders nach vorne, und sind bereits bei 5 mm Länge wesentlich weiter entwickelt als bei dem nur 1 mm kürzeren vorhergehenden Stadium. Besonders die epineurale Reihe ist bereits bis zum Gehirn ausgedehnt. Zwischen der auch bei diesem Typ deutlichen gürtelartigen postanalen Pigmentzone und der Schwanzflosse ist auch hier eine ziemlich pigmentfreie Zone vorhanden. Die durch ihre Größe besonders hervorgehobenen Chromatophoren in der Dorsal- und Ventralreihe sind oben bereits erwähnt. Auf der Schwanzflosse ist die Pigmentierung etwas stärker als beim Typ A. Eine Gruppe von Chromatophoren liegt ventral vor dem Schultergürtel. An der Pigmentierung des Eingeweidesackes und des Kopfes ist nichts charakteristisches zu bemerken.

In der Bedornung der Kiemendeckel ist, besonders im Hinblick auf die Variabilität in Zahl und Ausbildung der Dornen, ebenfalls nichts als charakteristisch für diesen Typ zu bezeichnen.

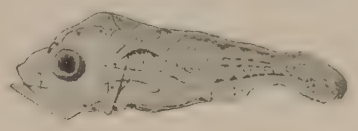
Die Entwicklung der unpaaren Flossen setzt schon sehr früh ein, wie auch die Wirbelsäule sich sehr früh differenziert. Bereits bei 4 mm Länge sind die ersten Anlagen von Rücken-, After- und Schwanzflosse recht weit entwickelt. Die Schwanzplatte zeigt in ihrer Anlage keine grundsätzlichen Unterschiede gegenüber *C. trachurus* und Typ A.

Ob die Typen A und B als Entwicklungsstadien von *C. mediterraneus* und *C. Cuvieri* anzusehen sind, ist vorläufig nicht zu entscheiden. Die Möglichkeit besteht jedoch. Die Pigmentierung stimmt in ihrem Hauptcharakter, auch wenn man *C. trachurus* noch mit zum Vergleich heranzieht, überein, es sind mehr kleinere, graduelle Abweichungen, die bestehen. Auch die Bedornung des Präoperkulums, der Bau der Schwanzflosse, die Bezahnung stimmen zwischen allen drei Formen überein. Die Unterschiede bei den Entwicklungsformen sind also gering, wie die Unterschiede bei den Erwachsenen auch nur gering sind. Das könnte also alles dafür sprechen, dass die Typen A und B je mit einer der beiden genannten Arten identisch wären.

Typ C (Abb. 10 und 11): Ein einzelnes, im Bosporus (Stat. 171, $^{10}/_{8}$ 1910) gefangenes Exemplar von 4,5 mm Länge wird hier gesondert dargestellt. Es hat gewisse Ähnlichkeiten mit allen bisher behandelten Formen, aber doch sind wieder einzelne so wesentliche Unterschiede vorhanden, daß es nicht möglich ist, dieses Stadium irgend einer der vorherigen Formen einzugliedern. In der verhältnismäßig geringen Höhe und sonstigen Punkten des Habitus gleicht dieses Stadium am ehesten *C. trachurus*, aber damit stimmt die Pigmentierung in keiner Weise überein, die beim Typ C wesentlich geringer ist, besonders dorsal, visceral und am Kopf, als bei *C. trachurus* von gleicher Größe. Am meisten ähnelt diese Larve in der Pigmentierung dem Typ A, aber das postanale Pigment ist beim Typ C, obwohl kleiner, wesentlich

stärker entwickelt als beim Typ A, aber noch keineswegs so stark wie beim Typ B. Der Typ C nimmt in dieser Beziehung also eine Mittelstellung zwischen A und B ein. Wesentlich abweichend ist ferner das Fehlen des Pigments über dem Enddarm.

Die Bedornung des Kiemendeckels (Abb. 11) läßt keine Besonderheit erkennen. Die innere Differenzierung ist noch nicht so weit fortgeschritten wie bei den Typen A und B, aber weiter als bei *C. trachurus*. Der Eingeweidesack hat eine mehr gestreckte Form als der von Typ A und B, er kommt in seiner Form eher dem von C. trachurus näher.



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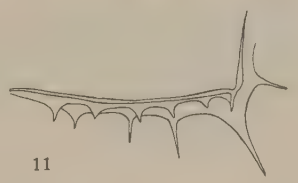


11

Abb. 10 Typ C (Bosporus) 4,5 mm.
Abb. 11 Typ C, Kiemendeckel-Bedornung.

Typ D (Abb. 12), *Caranx fusus*?: Mit dieser Bezeichnung ist ein einzelner Jungfisch von 20 mm Länge belegt, gefangen Stat. 341 (»Pangan«), südlich von Kreta. Dieser trotz seiner geringen Körperlänge schon metamorphosierte Fisch zeigt eine zur Länge sehr große Körperhöhe. Diese ist etwa dreimal in der Körperlänge enthalten. Die Seitenlinie ist vorne stark gebogen, hinten gerade. Die Schilder auf der Seitenlinie sind noch nicht sicher zu zählen. Auf dem hinteren, horizontalen Teil sind sie auf einer kurzen Strecke schon ganz deutlich, es sind vielleicht 40—50 vorhanden, aber genauer ist die Zahl nicht zu bestimmen. Das Präoperkulum ist sägeartig bedornt. Rücken- und Afterflosse sind gut ausgebildet, die Formeln lauten: D. I 8, D. II $^{1}/_{23}$, A. 2 $^{1}/_{19}$.

Die Identifizierung dieses Exemplars ist nicht leicht. Das einzige sicher bestimmbare Merkmal ist die Strahlenzahl von Rücken- und Afterflosse, und dieses Merkmal allein reicht nicht zu einer sicheren Unterscheidung aus. Das Verhältnis von Höhe zur Länge bei einem so jugendlichen Stadium kann bei größeren Fischen, die als Maßstab für die Bestimmungsübersichten gegeben sind, vollkommen anders sein. Die Schilderzahl der Seitenlinie kommt hier als unsicher oder garnicht bestimmbar ebenfalls nicht in Frage.

Es kann sich nach dem allgemeinen Habitus und nach der Strahlenzahl in der ersten Rückenflosse nur um einen Angehörigen der Gattung *Caranx* handeln. Carus (2) gibt für das Mittelmeer, außer den drei als Gattung *Trachurus* abgetrennten Formen, sieben *Caranx*-Arten an, von denen eine, *C. alexandrinus*, wohl nicht zur Gattung *Caranx* gerechnet werden kann. Von den übrigen sechs Arten kämen nach der Zahl der Flossenstrahlen nur *C. fusus* und *C. carangus* in Frage, von denen aber die letzte Form wegen der geringen Schilderzahl 30—33 auf der Seitenlinie ausscheiden muß. Es bliebe demnach nur *C. fusus* übrig, dessen Schilderzahl (45) ebenfalls zutreffen würde, vorausgesetzt daß bei dem vorliegenden Exemplar die Ausbildung der Schilderzahl auch beim weiteren Wachstum auf den horizontalen Teil der Seitenlinie beschränkt geblieben wäre. Von den übrigen, sonst nur von außerhalb des Mittelmeeres bekannten *Caranx*-Arten, könnte nach der Zahl der Flossenstrahlen und Schilder nur *C. chrysos* in Frage kommen, der in diesen beiden Merkmalen vollkommen mit *C. fusus* übereinstimmt. Die Verbreitung spricht aber dagegen, daß es sich hier um *C. chrysos* handeln könnte. Es bliebe also nur *C. fusus* für das hier besprochene jugendliche Exemplar übrig.

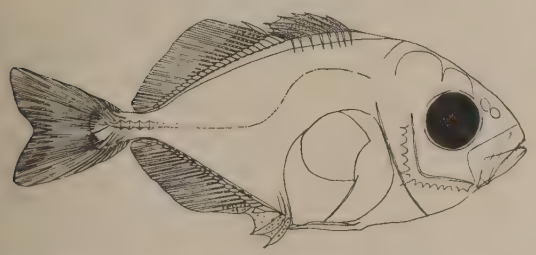


Abb. 12 Typ D (östl. Mittelmeer), Caranx fusus?, 20 mm.

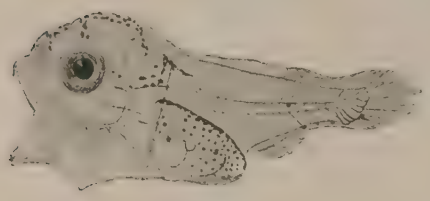
Die wesentlich schlankere Körperform erwachsener *C. fusus*, die Höhe beträgt etwa $^{1}/_{4}$ der Länge, während sie bei der vorliegenden Jugendform noch nicht ganz $^{1}/_{3}$ beträgt, spricht nicht unbedingt gegen die Annahme, daß es sich hier um *C. fusus* handelt, da die Körperproportionen sich bekanntlich im Laufe des Wachstums wesentlich ändern können.

Typ E. (Abb. 13—16). *Caranx dentex?:* Von diesem Typ liegen zwei Exemplare vor, von Stat. 126,

$^{10}/_{7}$ 1910, 5 mm und Stat. 297 (»Pangan«), $^{25}/_{6}$ 1911, 6 mm, die erste aus der Gegend von Korsika, die zweite aus dem Gebiet zwischen Kreta und Nord-Afrika.

Dieser Typ unterscheidet sich in verschiedenen Merkmalen ganz wesentlich von allen bisher besprochenen Formen gleicher Entwicklungsstadien. Er hat von allen die größte Körperhöhe, die geringste postanale Pigmentierung, und am auffallendsten sind die großen, spitzen Zähne (Abb. 14), die in diesem Stadium nur vorne entwickelt sind. Weiter hinten sieht man aber bereits weitere Zähne in den Alveolen sitzen. Die bisher behandelten Typen gleichen Entwicklungsstadiums zeigten dagegen kurze konische Zähne.

Bei dem 6 mm langen Exemplar ist die Schwanzflosse schon ziemlich weit entwickelt, dann folgt



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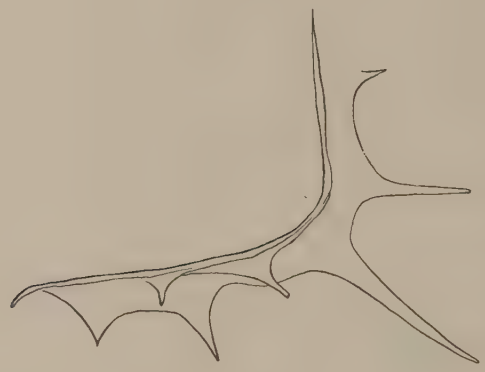


16

Abb. 13 Typ E (westl. Mittelmeer) Caranx dentex?, 6 mm.
- 14 - E, Bezahnung.
- 15 - E, Schwanzflosse.
- 16 - E, Kiemendeckel-Bedornung.

in der Entwicklung die Afterflosse, die vorne am weitesten fortgeschritten ist, und am meisten zurück von den vertikalen Flossen ist die Rückenflosse. In der Schwanzflosse (Abb. 15) zeigt sich noch eine weitere Abweichung von den bisher besprochenen Larvenformen. Bei diesen war das 4. Hypurale aus zwei Bestandteilen zusammengesetzt, die wohl in der ersten Zeit der Entwicklung noch gut erkennbar, aber doch schon sehr weit miteinander verschmolzen waren. Beim vorliegenden Typ sind diese beiden Bestandteile noch sehr viel deutlicher getrennt. Ob und wie weit sie später ganz miteinander verschmelzen, kann vorläufig nicht gesagt werden, da weitere Entwicklungsstadien fehlen.

Die Bedornung des Kiemendeckels (Abb. 16) ist ebenfalls etwas abweichend von derjenigen der bisher besprochenen Typen. Die Zahl der Dornen ist auf dem horizontalen Ast sowohl des Präoperkularrandes wie der Crista geringer, auf der Christa fehlt zudem, jedenfalls bei dieser Größe, der Eckdorn. Die Dornen, besonders auf der Crista, sind verhältnismäßig groß.

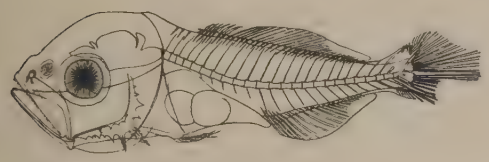
Die Pigmentierung ist am stärksten im vorderen Teil des Körpers entwickelt, über dem Gehirn

und dem vordersten Teil des Neuralrohres sowie auf dem Eingeweidesack. In dem postanalen Körperabschnitt liegen nur in der letzten Hälfte vereinzelte Chromatophoren, und zwar ventral und median.

Irgend welche Anhaltspunkte in den Flossenstrahlen zur Identifizierung sind bei diesem Stadium noch nicht vorhanden. Wenn ich lediglich auf Grund der starken Bezahnung die Vermutung ausspreche, daß es sich hier um *C. dentex* handeln könnte, so wird eine endgültige Entscheidung natürlich erst nach Prüfung weiteren Materials möglich sein.

Typ F (Abb. 17—19): Dieser Typ zeigt in mancher Beziehung erhebliche Abweichungen von allen bisher besprochenen Formen. Es liegt nur ein einziges Exemplar von 11.5 mm Länge vor, gefangen auf Stat. 437 (»Ingolf«), $^{17}/_{11}$ 1911, auf 19°11′ N, 54°15′ W, also im Westatlantik östlich der Antillen.

Abweichend ist zunächst die Flossenformel, D. I 6, D. II 28 oder $^{1}/_{27}$, A. $^{1}/_{21}$. Die Wirbelzahl beträgt 10 + 14. In der zweiten Rückenflosse ist in dem vorliegenden Stadium noch nicht genau zu erkennen,



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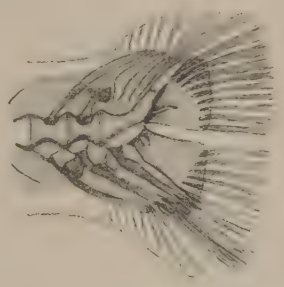

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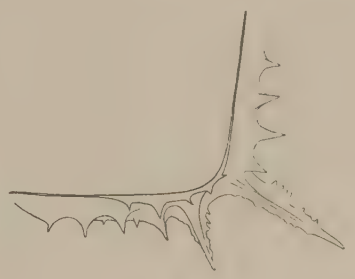

19

Abb. 17 Typ F (West-Atlantic), 11.5 mm.
- 18 - F, Schwanzflosse.
- 19 - F, Kiemendeckel-Bedornung.

ob sich der erste Strahl stachelig ausbilden wird, gewisse Anzeichen dafür scheinen vorhanden zu sein. Wenn man die Flossenformel als Richtlinie nimmt, so könnte man dieses Stadium *Caranx helvolus* zurechnen, wofür Günther als Flossenformel D. I 6, D. II $^{1}/_{28}$, A. $^{1}/_{20}$ angibt. Kein anderer Carangide hat eine Strahlenzahl, die dieser gleich kommt. Eine sichere Entscheidung ist jedoch nicht möglich.

Es ist eine ziemlich starke Bezahnung vorhanden, die Zähne haben kurz kegelförmige Gestalt. Besonders charakteristisch ist die starke Kiemendeckelbedornung (Abb. 19). In erster Linie sind der Eckdorn und der darunter liegende Dorn sehr entwickelt, und ihre Ränder zeigen tiefe Ausbuchten, während sonst die Ränder vollkommen glatt sind. Die Crista ist verhältnismäßig schwach bedornt.

Die Schwanzflosse (Abb. 18) zeigt nur ganz unwesentliche Abweichungen von den der anderen bisher behandelten Formen. Das 1. Hypurale ist nur ganz klein. Das 2. Hypurale ist mit dem 3. Hypurale auf diesem Stadium schon sehr weit verschmolzen. Die Zusammensetzung des 4. Hypurale aus zwei Bestandteilen ist erkennbar. Es sind nur zwei Epuralia vorhanden im Gegensatz zu drei bei den bisher behandelten Formen. Die Formel für die Schwanzflosse ist hier ganz die gleiche wie bei den anderen Carangiden.

Eine Pigmentierung ist an dem vorliegenden Exemplar nicht sichtbar mit Ausnahme einer einzigen Pigmentzelle am vorderen Rand des Unterkiefers. Ob sonst überhaupt kein Melanin vorhanden ist, oder ob dieses, vielleicht nur schwach entwickelt, infolge der Konservierung und des Alters des Materials verblaßt ist, kann nicht entschieden werden. Möglich ist dieses, weil auch das Augenpigment fast vollkommen verschwunden ist.

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REPORT ON THE DANISH OCEANOGRAPHICAL EXPEDITIONS 1908—10
TO THE MEDITERRANEAN AND ADJACENT SEAS
Vol. III. Miscellaneous Papers.

6.

Nitrate and Phosphate contents of Mediterranean water

by

Helge Thomsen.

With 2 figures and 1 chart in the text.

Published October 15., 1931.

In 1908—10, when the "Thor" carried out its Mediterranean cruises, the hydrographical results of which were described in Vol. I of this Report, the importance of the natural food-stuffs (phosphates and nitrates) was not so generally recognised as now. Nor had we at that time the comparatively simple methods for use on board ship which are at our disposal at the present day.

One of the chief reasons for the decision of Professor Johs. Schmidt, the Leader of the Carlsberg Foundation's Oceanographical Expedition round the world 1928—1930, to include the Mediterranean in the investigations of this Expedition, was therefore just to study the nitrate and phosphate contents in that sea and thus to introduce new hydrographical information which might eventually contribute towards a better understanding of the biological phenomena.

During the Mediterranean portion of the cruise of the Royal Danish research-ship "Dana", with which the Expedition round the world was made, in the period from 9, April to 9, June 1930, hydrographical observations were undertaken at 39 stations, as shown on the Chart fig. 1. In addition to the determination of temperature, salinity and oxygen determinations of the nitrate and phosphate contents were also made at these stations.

The samples from which the nitrate and phosphate determinations were made, were preserved in the dark until the analyses could be carried out, as a rule in the course of 24 hours after taking the samples.

For the nitrate determinations Denigés' reagent was used after Harvey's method (1), and the results are expressed in milligrams of nitrate nitrogen per cubic metre of sea-water.

The colorimetric measurement was made in a Sund's colorimeter (2) with the standard solutions of $NaNO_3$ in nitrate-free, natural sea-water charged with sublimate. As colorimetric tube a flat-bottomed reagent glass was used, 97 mm. high with 15 mm. diameter outside. The determination was made on 7 c.c. sea-water with the addition of the same volume of the reagent. After the addition of the reagent to the samples and standard solutions these were allowed to stand in the dark about 6 hours before the determination was made by the author.

For the phosphate determinations Denigés' method was used in the form introduced into oceanographical work by Atkins (3). For the colorimetration 35 cm. long glass tubes were used; the samples were compared with a series of standard solutions of Na_2HPO_4, 2 H_2O (after Sørensen) dissolved in distilled water.

The colorimetration was made 10—30 minutes after the addition of the reagent to the samples and standard solutions, and the results expressed in milligrams P_2O_5 per cubic metre sea-water.

To be able to carry out the colorimetration of series of up to 24 samples within the time mentioned, which is desirable owing to the gradual fading of the colour produced, two persons were employed at the same time, the one manipulating the samples and standard solutions in the tubes, whilst the other made the actual comparisons. This was always carried out by Mag. sc. A. F. Bruun.

The accuracy with which the colorimetric measurements were made may certainly be placed at

$\pm$ 5 mg P_2O_5/m^3 for the phosphate determinations. In the nitrate determinations we may reckon with an error of $\pm$ 3 mg N_2/m^3 for the low values and $\pm$ 10 mg N_2/m^3 for the highest values in the Mediterranean, whereas for the highest values in the open oceans (500—600 mg N_2/m^3) still greater uncertainty must be reckoned with. Yet we cannot take it as certain, that the values found lie exactly within the indicated limits of colorimetric accuracy. As the reagents are so sensitive, we must be prepared for chance errors caused by contamination of samples and standard solutions, especially in the nitrate determinations. Let us assume that we are using 10 c.c. sea water for nitrate determinations and that in this, for example, we find 10 mg N_2/m^3, this will mean that we have had in the reagent glass a tenthousand part mg nitrogen. A contamination of such a dimension will thus cause the chance error to exceed the colorimetric accuracy.

As mentioned, the methods used for the nitrate and phosphate determinations have been worked out at the Laboratory of the Marine Biological Association, Plymouth, the director and staff of which have shown the greatest interest in the "Dana"-Expedition. The director, Dr. E. J. Allen, F. R. S., presented to the Expedition the tubes used in the phosphate determinations and to Dr. W. R. G. Atkins, F. R. S. and Mr. H.W. Harvey, M. A., my best thanks are due for valuable advice.

The tables 1 and 2 give the values of nitrate and phosphate found in Mediterranean water. They are grouped in 7 regions, the boundaries of which are indicated on the Chart fig. 1. It will be seen that the regions embrace the following parts of the Mediterranean.

Area I. Gibraltar Straits and Alboran Sea.
— II. Balearic Sea, southernmost part.
— III. Between Sardinia and Tunis.
— IV. Tyrrhenian Sea, southern part.
— V. Straits of Messina.
— VI. Ionian Sea.
— VII. Aegean Sea.

Within each of these regions and for the same depth an average has been formed for the nitrate and phosphate contents, and these averages are marked on the diagrams figs. 2 and 3.

From Table 1 it appears that, excluding regions III and V, the amount of nitrate found at the surface everywhere was small or none. Below the surface we have a gradual increase with the depth down to about 1000 m., and thereafter the nitrate content remains almost contant to the bottom. In the regions III and V there is a somewhat greater nitrate content between 0 and 100 m. than in the adjacent regions. This can be explained from the fact, that both III and V are transitional regions, where there is a possibility of mixing between the waters of the surface and deeper layers, so that nitrate is brought from the depths to the otherwise nitrate-free surface layer.

Comparing now the nitrate content at the same depth in the different regions we see, that a decrease takes place on going from Gibraltar eastwards. From this rule, however, there are the following exceptions.

1. The already mentioned, relatively high nitrate content in the uppermost 100 m. in regions III and V.
2. In region V, in depths greater than 500 m., we find smaller quantities of nitrate than in the 2 adjacent regions. This phenomenon may also possibly be due to mixing, the nitrate-rich deep layers giving up nitrate to the surface.
3. Lastly, in depths greater than 1000 m. we find just as much, and in some depths even more, nitrate in region IV than in region II.

Table 2 shows that the phosphate distribution in the Mediterranean resembles that of the nitrate. Thus in all regions we find no phosphate or but very little in the surface water; below the surface

200 m
2000 m
FRANCE
ESPAÑA
PORTUGAL
ITALIA
AFRICA
I
II
III
IV
V
VI
VII
10°
0°
10°
20°
30°
50°
45°
40°
35°
30°

Fig. 1.

the phosphate content rises with the depth down to 1000 m., after which the quantity is almost constant to the bottom. But some stations show a slight decrease below 1500—2000 m.

Comparing the phosphate content at the same depth in the different regions we find here also a decrease from west to east. But the following deviations from the uniform decrease occur.

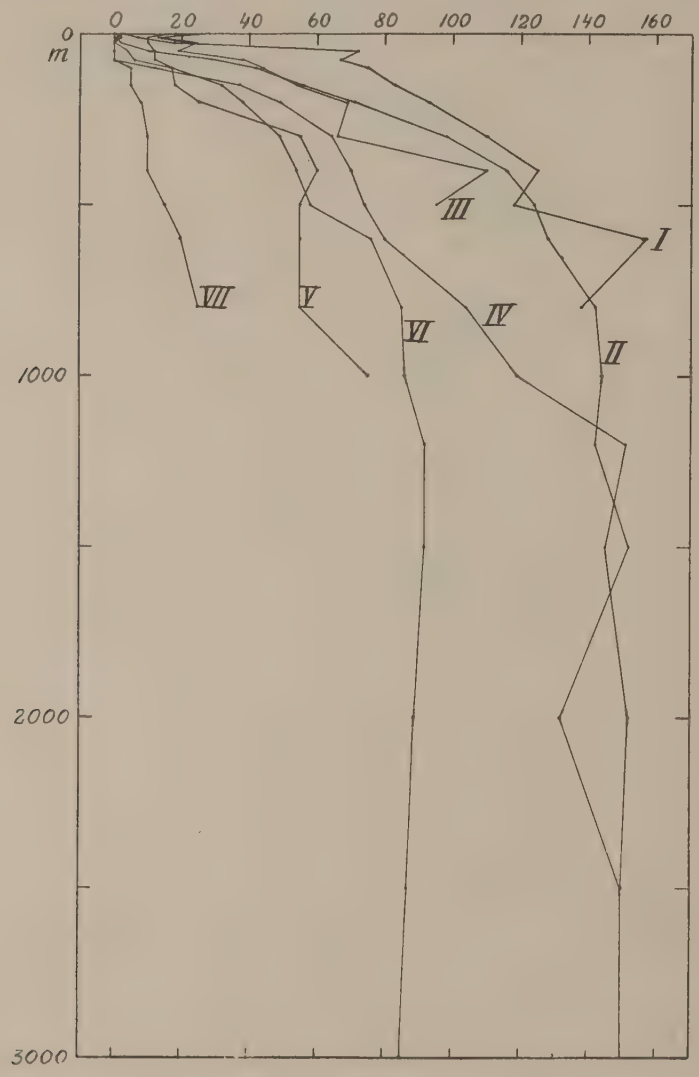

Fig. 2.

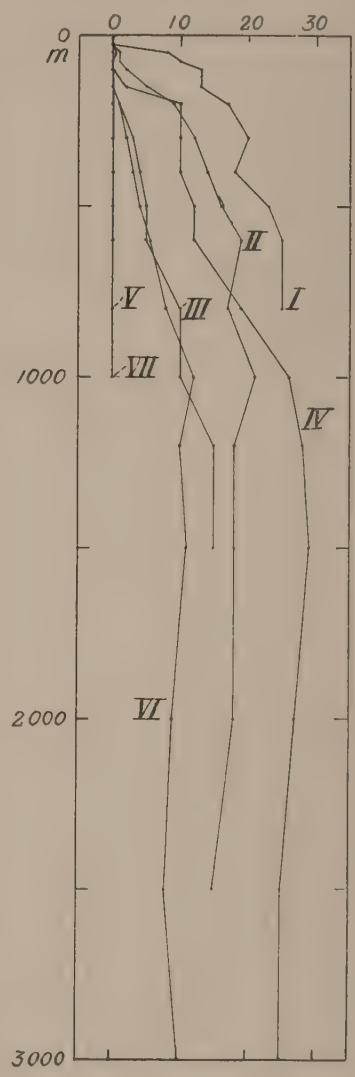

Fig. 3.

1. In both regions III and V there is less phosphate than in the adjacent regions. Just as was the case with the nitrate content, however, this is fully explained by the fact, that in these regions there is a possibility of mixing between the upper and lower layers, which leads to the phosphate from the deep water being given up to the surface and there consumed by organisms requiring phosphate.
2. In region IV in depths greater than about 800 m. we find a greater phosphate content than in corresponding depths in region II, just as was found for the nitrate content.

Although the quantity of nitrate and phosphate increases considerably as we go from the eastern part of the Mediterranean to the western, yet the quantity of phosphate and nitrate even in the westernmost

part is considerably less than at the same depths in the oceanic regions, where observations were made during the cruise round the world in 1928—30.

For the sake of comparison Tables 3, 4, 5, and 6 show the values of nitrate and phosphate from different regions of the Atlantic, Indian and Pacific Oceans. It will be seen from the Tables, that in general the nitrate and phosphate content increases regularly from 0 or small values in the surface water to high values in deep, thereafter at some stations decreasing a little again towards the bottom. It will be seen further, that in the same depths the quantity of nitrate and phosphate is almost equally great in the Indian and Pacific Oceans, whilst it is somewhat less in the Atlantic Ocean.

To simplify the survey, of the values given in Tables 1—6 the lowest and highest for each depth in the Mediterranean and the oceans have been picked out and given separately in Tables 7 and 8. The columns to the right in Table 7 show how many times the minimum and maximum nitrate content in the oceans exceeds the corresponding minimum and maximum content in the Mediterranean, the quotients being rounded off to the nearest whole number, except for the deep fractions where 1 decimal is included.

It will be seen, that in depths greater than 200 m. the maximum nitrate content is everywhere 3 to 4 times greater in the Indian and Pacific Oceans, and 2—4 times greater in the Atlantic than in the Mediterranean. For the minimum values the quotients are very high in depths between 200 and 600 m. corresponding to the very low minimum values in the Mediterranean. In this depth interval the quotients lie between 10 and 23 for the Atlantic, between 8 and 14 for the Indian and 0 and 18 for the Pacific Ocean. In depths below 600 m. the quotients are more uniform and lie between 3—4 in the Atlantic, 5—7 in the Indian Ocean and 4—5 in the Pacific. Lastly, we note that in depths greater than 400 m. the maximum values in the Mediterranean are less than the minimum values in the oceans.

On the other hand, the conditions in the surface layer from 0 down to 200 m. are scarcely so simple. Considering the minimum values, it will be seen that these are either equally large (i. e. both 0) or less in the Mediterranean than in the oceans, with exception of the Pacific where the minimum value is 0 in 200 m. against 5 at the same depth in the Mediterranean.

The maximum values, however, are higher in the Mediterranean than in the Atlantic and Indian Oceans in the uppermost 50 m., but lower below this depth; yet it has to be noted, that the high values in the Mediterranean come from region III and thus may be considered to have arisen from a mixing with the deeper layers.

In the Pacific the maximum values are everywhere higher than those of the Mediterranean. These high nitrate values in the Pacific come from St. 3558, which though situated right under the equator has the relatively low surface temperature of 19.1°. This, in conjunction with the remaining hydrographical data indicates that here also a mixing of the surface and deeper layers takes place, which explains the high nitrate content.

In these comparisons of the surface content of nitrate and phosphate between the Mediterranean and the oceans one must however, take into consideration, that considerable variations may occur with the season of the year, at those stations at any rate which lie outside the tropics.

Table 8 gives the minimum and maximum values of the phosphate content. It will be seen that the minimum value in the Mediterranean is 0 down to a depth of 600 m.; below this depth we have very high quotients, from 3—19 in the Atlantic, from 10—26 in the Indian Ocean and from 12—28 in the Pacific, corresponding to the very low phosphate minima in the Mediterranean. The quotients for the maximum values, excluding the uppermost 100 m., are fairly uniform and lie between 3—5 in the Atlantic, between 5—7 in the Indian Ocean and likewise between 5—7 in the Pacific. In the uppermost 100 the quotients of the maximum values are variable, but everywhere equal to or greater than 1. Lastly, it appears from Table 8, that below 300 m. the minimum values in the oceans are greater than the maximum values in the Mediterranean. So far as the Atlantic is concerned, however, the minimum values at 600, 800 and 1000 m. are equal to the maximum values in the Mediterranean at the same depths. This is explained by the fact, that these minima, as appears

from Table 4, occur at St. 4149 at just the same depths in which there is a temperature maximum (T>12°) due to the Mediterranean water flowing out through the Straits of Gibraltar. One may notice further, that a corresponding minimum is also found in the nitrate values, and on considering Tables 3 and 4 it will be seen that similar minima occur at all the stations in Cadiz Bay and west of Portugal (4142, 4147, 4148, 4149, and 4156), where the influence of the Mediterranean water is so strong, that it shows itself in an inversion of the temperature.

In Table 9, lastly, are given the nitrate and phosphate values for some stations lying in the enclosed seas of the tropics: Banda Sea, Celebes Sea, Sulu Sea, Mindanao Sea, the South China Sea and the Caribbean Sea. Comparison of the nitrate and phosphate values indicated with the Tables 7 and 8 shows, that the nitrate and phosphate content in the 5 East Indian seas is far greater than in the Mediterranean, being of the same dimensions as in the Indian and Pacific Oceans; in some depths one even finds nitrate values which are a little greater than the maximum value at the same depth in the 2 oceans. In the Caribbean Sea we have phosphate and nitrate values which are a good deal smaller than those found in the East Indian seas, but of the same dimension as those found in the Atlantic.

As is known, one of the most striking differences between the Mediterranean and the oceans, so far as the hydrography is concerned, is found in the fact that, whilst the temperature in the latter decreases from the surface to 1—3° in great depths, in the Mediterranean the temperature even at the greatest depths does not go below about 13°.

As background to this a comparison between the Mediterranean and the Sulu Sea, with the connected Mindanao Sea, is of special interest, as the temperature in the Sulu Sea is everywhere greater than 10.1° and in the Mindanao Sea greater than 11.7° (1500 m.). In spite of this, however, the nitrate and phosphate content, as noted above, is of the same dimension as that of the oceans and thus much greater than the Mediterranean's and thus, so far as the great depths are concerned, the nitrate and phosphate content does not seem in any great degree dependent on the temperature. It would appear certainly, that the Sulu Sea and the Mindanao Sea contain somewhat less phosphate and the Mindanao Sea also less nitrate than the surrounding seas with lower temperatures in deep water, but the difference is small considering that these 2 seas, so far as the temperature in deep water is concerned, approximate closely to the Mediterranean.

An explanation of the low contents of nitrate and phosphate in the Mediterranean is probably to be found in the exchange of water through the Straits of Gibraltar. As well known [Nielsen (4)], surface-water from the Atlantic enters the Mediterranean through the Straits of Gibraltar and water from greater depths in the Mediterranean pass out in the Atlantic. As the present observations show that the surface-water contains less nitrate and phosphate than the deeper layers, the exchange of water through the Straits of Gibraltar will cause an exhaustion of nitrate and phosphate in the Mediterranean.

In conclusion, it should perhaps be noted, that the available material from the Mediterranean comes exclusively from the southern parts. There is thus a possibility, that the nitrate and phosphate distribution may be different in the northern parts of the Balearic and Tyrrhenian Seas. Nevertheless, so far as the available observations go, there is no reason to believe that the nitrate and phosphate content in these regions will be so very different from those of the other regions investigated, that they will affect the picture of the Mediterranean as distinctly a nitrate and phosphate poor sea.

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Tab. 1. Mediterranean, Nitrates.

	St. Nr.	Date	Depth 0	10	25	50	75	100	150	200	300	400	500	600	800	1000	1200	1500	2000	2500	3000	3500	4000
Area I.	4025	9. IV	10	20	40	80	65	75	75	90	115	140	115	165	125	..	..	..	..	..	..	..	..
	4027	11. IV	0	0	0	75	70	85	125	120	135	140	145	130	150	..	..	..	..	..	..	..	..
	4140	9. VI	0	0	15	60	65	65	55	70	80	95	95	175	..	..	..	..	..	..	..	..	..
	Mean:		3	7	18	72	67	75	85	93	110	125	118	157	138	..	..	..	..	..	..	..	..
Area II.	4028	11. IV	20	5	20	30	85	75	85	95	115	115	140	135	160	200	175	175	..	..	..	..	..
	4029	11. IV	0	0	0	0	35	35	..	80	75	100	100	..	..	..	..	..	..	..	..	..	..
	4031	13. IV	0	0	0	0	5	50	40	50	95	100	125	135	130	130	..	..	..	..	..	..	..
	4032	13. IV	0	0	0	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	4034	21. IV	0	0	0	0	15	15	45	50	70	100	95	100	125	115	115	120	115	..	..	..	..
	4124	4. VI	0	0	0	5	20	20	35	70	140	140	140	140	150	150	..	..	..	..	..	..	..
	4136	6. VI	0	0	0	20	30	30	65	70	115	125	135	125	135	135	..	..	..	..	..	..	..
	4137	7. VI	0	0	0	0	25	60	75	100	100	135	135	135	150	135	135	160	150	150	..	..	..
	4138	7. VI	0	0	0	35	20	50	50	50	70	..	125	..	..	..	..	..	..	..	..	..	..
	Mean:		2	1	2	11	29	42	56	71	98	116	124	128	142	144	142	152	132	150	..	..	..
Area III.	4038	23. IV	5	5	0	5	20	40	40	45	55	65	65	..	..	..	..	..	..	..	..	..	..
	4039	23. IV	3	2	0	0	5	30	45	32	15	115	125	..	..	..	..	..	..	..	..	..	..
	4041	24. IV	45	15	10	25	70	70	65	125	95	150	..	..	..	..	..	..	..	..	..	..	..
	4042	24. IV	65	45	60	50	65	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	4044	25. IV	75	25	90	45	70	70	65	75	100	..	..	..	..	..	..	..	..	..	..	..	..
	4045	25. IV	5	0	5	0	0	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	4046	25. IV	0	0	0	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	Mean:		28	13	24	19	38	44	54	69	66	110	95	..	..	..	..	..	..	..	..	..	..
Area IV.	4049	2. V	0	0	0	0	0	15	25	45	45	45	55	65	80	100	150	125	135	..	..	..	..
	4052	4. V	0	2	0	0	0	0	8	15	55	55	55	65	100	100	135	135	..	..	..	..	..
	4119	30. V	0	0	0	0	0	5	70	75	80	100	100	100	135	135	160	160	160	150	..	150	..
	4120	31. V	0	0	0	0	0	30	45	60	75	80	85	90	100	140	160	160	160	..	..	..	..
	Mean:		0	0	0	0	0	12	37	49	64	70	74	80	104	119	151	145	152	150	..	150	..
Area V.	4053	5. V	10	0	0	0	0	10	15	25	60	65	..	..	..	..	..	..	..	..	..	..	..
	4054	5. V	35	15	15	15	15	20	20	25	50	55	55	55	55	75	..	..	..	..	..	..	..
	4055	6. V	10	15	15	20	20	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	Mean:		18	10	10	12	12	17	18	25	55	60	55	55	55	75	..	..	..	..	..	..	..
Area VI.	4059	10. V	0	0	0	5	0	10	20	25	45	25	25	75	70	75	..	..	..	..	..	..	..
	4064	13. V	0	5	5	5	0	0	0	25	30	40	50	85	100	95	100	90	90	90	80	90	80
	4067	14. V	0	0	0	0	0	15	30	30	60	85	60	75	85	80	80	80	80	..	..	..	..
	4068	15. V	0	0	0	0	0	0	45	45	50	65	85	90	90	90	..	..	..	..	..	..	..
	4070	16. V	0	0	0	0	0	0	5	15	15	20	25	60	85	95	90	95	95	90	90	90	90
	4073	20. V	0	0	0	15	25	55	55	55	70	..	..	..	..	..	..	..	..	..	..	..	..
	4074	21. V	5	0	0	10	35	55	70	70	70	75	75	75	75	..	..	..	..	..	..	..	..
	4075	22. V	0	0	0	0	0	0	15	35	50	65	70	75	95	100	..	100	95	..	..	..	..
	4076	22. V	5	5	0	0	0	5	35	40	50	55	65	70	85	80	100	95	85	80	..	..	..
	4077	23. V	10	0	0	0	0	30	45	45	50	55	65	75	80	75	..	..	..	..	..	..	..
	Mean:		2	1	0	4	6	17	32	38	49	54	58	76	85	86	92	92	89	87	85	90	85
Area VII.	4071	17. V	0	0	0	0	0	5	10	10	10	10	15	20	25	..	..	..	..	..	..	..	..
	4072	18. V	0	5	0	0	0	5	0	5	10	..	..	..	..	..	..	..	..	..	..	..	..
	Mean:		0	2	0	0	0	5	5	8	10	10	15	20	25	..	..	..	..	..	..	..	..

Tab. 2. Mediterranean, Phosphates.

	St. Nr.	Depth / Date	0	10	25	50	75	100	150	200	300	400	500	600	800	1000	1200	1500	2000	2500	3000	3500	4000
Area I.	4025	9. IV	0	0	0	15	10	15	10	15	20	20	30	30	20	..	..	..	..	..	..	..	..
	4027	11. IV	0	0	0	5	10	15	20	25	25	15	20	25	30	..	..	..	..	..	..	..	..
	4140	9. VI	0	0	0	5	10	10	10	10	15	..	20	20	..	..	..	..	..	..	..	..	..
	Mean:		0	0	0	8	10	13	13	17	20	18	23	25	25	..	..	..	..	..	..	..	..
Area II.	4028	11. IV	0	0	0	0	0	0	0	5	10	15	20	15	15	20	15	15	..	..	..	..	..
	4029	11. IV	0	0	0	0	0	0	5	10	10	10	10	..	..	..	..	..	..	..	..	..	..
	4031	13. IV	0	0	0	0	0	5	5	5	10	15	15	20	15	15	..	..	..	..	..	..	..
	4032	13. IV	0	0	0	0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	4034	21. IV	0	0	0	0	0	0	5	15	15	15	25	25	..	30	25	25	20	..	..	..	..
	4124	4. VI	0	0	0	0	0	0	0	5	10	15	15	15	15	20	..	..	..	..	..	..	..
	4136	6. VI	0	0	0	5	5	5	10	15	25	25	15	25	25	25	..	..	..	..	..	..	..
	4137	7. VI	0	0	0	0	0	0	10	15	15	15	15	15	15	15	15	15	15	15	..	..	..
	4138	7. VI	0	0	0	5	5	5	5	5	5	5	10	..	..	..	..	..	..	..	..	..	..
	Mean:		0	0	0	1	1	2	5	9	12	14	16	19	17	21	18	18	18	15	..	..	..
Area III.	4038	23. IV	0	0	0	0	0	0	0	5	5	5	5	..	..	..	..	..	..	..	..	..	..
	4039	23. IV	0	0	0	0	0	0	0	0	0	0	5	..	..	..	..	..	..	..	..	..	..
	4040	23. IV	0	0	0	0	0	0	0	0	5	5	5	5	10	10	15	15	..	..	..	..	..
	4041	24. IV	0	0	0	0	0	0	0	0	0	5	..	..	..	..	..	..	..	..	..	..	..
	4042	24. IV	0	0	0	0	0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	4044	25. IV	0	0	0	0	0	0	0	0	5	..	..	..	..	..	..	..	..	..	..	..	..
	4045	25. IV	0	0	0	0	0	0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	4046	25. IV	0	0	0	0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	Mean:		0	0	0	0	0	0	0	1	3	4	5	5	10	10	15	15	..	..	..	..	..
Area IV.	4049	2. V	5	0	0	0	0	0	5	10	10	10	10	10	20	25	25	25	25	..	..	..	..
	4052	4. V	0	0	0	5	0	0	0	10	10	10	15	10	15	25	25	25	..	..	..	..	..
	4119	30. V	0	0	0	0	0	0	5	15	15	15	15	15	20	25	30	30	25	25	25	25	..
	4120	31. V	0	0	0	0	0	0	0	5	5	5	10	15	20	30	30	35	30	..	..	..	..
	Mean:		1	0	0	1	0	0	2	10	10	10	12	12	19	26	28	29	27	25	25	25	..
Area V.	4053	5. V	0	0	0	0	0	0	0	0	0	0	..	..	..	..	..	..	..	..	..	..	..
	4054	5. V	0	0	0	0	0	0	0	0	0	0	0	0	0	0	..	..	..	..	..	..	..
	4055	6. V	0	0	0	0	0	0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	Mean:		0	0	0	0	0	0	0	0	0	0	0	0	0	0	..	..	..	..	..	..	..
Area VI.	4059	10. V	0	0	0	0	0	0	0	0	0	0	0	5	10	15	..	..	..	..	..	..	..
	4064	13. V	0	0	0	0	0	0	0	0	0	0	5	5	5	10	10	10	5	5	5	5	5
	4067	14. V	0	0	0	0	0	0	0	5	5	5	10	10	10	10	10	10	10	..	..	..	..
	4068	15. V	0	0	0	0	0	0	0	0	0	5	5	10	10	15	..	..	..	..	..	..	..
	4070	16. V	0	0	0	0	0	0	0	0	0	0	0	5	5	10	10	15	15	15	15	10	10
	4073	20. V	0	0	0	0	0	0	0	0	5	5	..	..	..	..	..	..	..	..	..	..	..
	4074	21. V	0	0	0	0	0	0	0	0	0	5	5	5	5	..	..	..	..	..	..	..	..
	4075	22. V	0	0	0	0	0	0	0	0	5	0	0	10	10	15	..	10	10	..	..	..	..
	4076	22. V	0	0	0	0	0	0	0	0	0	5	5	0	5	10	10	10	5	5	..	..	..
	4077	23. V	5	0	0	0	0	0	0	5	5	5	5	5	10	10	..	..	..	..	..	..	..
	Mean:		0	0	0	0	0	0	0	1	2	3	4	6	8	12	10	11	9	8	10	8	8
Area VII.	4071	17. V	0	0	0	0	0	0	0	0	0	0	0	0	..	..	..	..	..	..	..	..	..
	4072	18. V	0	0	0	0	0	0	0	0	..	..	..	..	..	..	..	..	..	..	..	..	..
	Mean:		0	0	0	0	0	0	0	0	0	0	0	0	..	..	..	..	..	..	..	..	..

Tab. 3. Atlantic Ocean.

	St. 3978 30°24′S 13°27′E 13-2-1930			St. 4000 0°45′S 11°01′W 4-3-1930			St. 4009 24°26′N 17°35′W 18-3-1930			St. 4019 33°08′N 10°22′W 30-3-1930			St. 4141 36°11′N 6°57′W 9-6-1930			St. 4142 36°01′N 7°29′W 10-6-1930		
Depth m.	t	N_2	P_2O_5	t	N_2	P_2O_5	t	N_2	P_2O_5	t	N_2	P_2O_5	t	N_2	P_2O_5	t	N_2	P_2O_5
0	19.52	0	0	26.80	0	0	19.50	0	10	16.50	0	0	19.15	0	15	19.0	0	0
10	19.50	5	5	26.84	0	0	19.52	0	10	16.63	5	0	18.69	0	0	18.32	0	0
25	19.40	0	5	25.37	0	5	19.49	0	10	16.63	0	0	18.01	0	0	17.83	0	0
50	19.29	15	10	24.11	35	20	19.40	0	10	16.41	5	0	16.11	0	5	16.27	0	0
75	14.60	100	30	17.59	250	70	19.30	5	10	16.27	5	0	15.88	0	5	15.83	0	0
100	13.73	100	35	14.11	275	80	18.88	5	10	15.92	25	5	15.58	20	5	15.60	15	0
150	13.12	125	35	13.49	275	90	17.66	60	15	14.92	95	30	14.48	95	20	14.43	125	30
200	12.52	200	50	13.03	350	100	16.09	125	40	13.88	150	40	13.60	175	20	13.60	175	30
300	10.68	250	60	9.73	—	130	13.85	185	50	12.69	175	45	12.40	220	40	12.23	250	45
400	9.04	275	75	7.90	525	135	12.44	225	65	11.84	—	60	11.62	240	45	11.48	250	50
500	6.97	450	90	6.36	500	150	11.18	325	90	11.24	225	60	11.16	275	50	11.06	250	50
600	5.08	450	115	5.30	525	150	9.75	375	110	10.56	375	80	10.68	300	70	10.62	325	50
800	3.68	475	130	4.49	550	150	7.70	425	130	10.42	375	80	9.93	375	70	10.28	375	70
1000	3.29	500	135	4.22	525	135	7.15	400	120	9.79	350	70	..	..	..	**10.41**	**325**	**60**
1200	3.02	500	135	4.38	450	125	6.53	375	100	9.54	325	70	..	..	..	..	..	..
1500	2.98	475	110	4.08	275	95	5.06	350	100	7.11	350	90	..	..	..	..	..	..
2000	2.98	425	90	3.49	250	90	3.70	325	100	4.33	375	90	..	..	..	..	..	..
2500	..	..	..	..	..	..	..	..	..	3.33	375	95	..	..	..	..	..	..
3000	..	..	..	..	..	..	..	..	..	2.90	375	95	..	..	..	..	..	..
3500	..	..	..	..	..	..	..	..	..	2.58	375	95	..	..	..	..	..	..
4000	..	..	..	..	..	..	..	..	..	2.50	375	..	..	..	..	..	..	..

Tab. 4. Atlantic Ocean.

	St. 4147 36°39′N 8°06′W 10-6-1930			St. 4148 37°02′N 9°17′W 11-6-1930			St. 4149 38°19′N 9°26′W 11-6-1930			St. 4156 42°41′N 9°49′W 16-6-1930			St. 4158 46°28′N 8°01′W 17-6-1930			St. 4159 47°20′N 6°28′W 19-6-1930		
Depth m.	t	N_2	P_2O_5	t	N_2	P_2O_5	t	N_2	P_2O_5	t	N_2	P_2O_5	t	N_2	P_2O_5	t	N_2	P_2O_5
0	18.0	0	0	17.0	5	0	16.7	8	5	15.6	5	0	17.5	2	0	15.4	20	0
10	17.28	0	0	16,80	0	0	16.25	5	0	15.52	5	0	15.96	2	0	15.36	5	0
25	16.53	0	0	15.88	0	0	15.50	0	0	15.30	5	0	14.95	5	0	14.94	15	0
50	15.46	0	5	14.82	5	0	14.91	0	0	14.42	5	0	11.91	35	15	11.52	100	15
75	14.92	15	5	14.19	60	5	14.73	20	0	13.78	20	0	11.27	115	30	11.24	110	25
100	14.79	45	10	13 46	100	25	14.36	10	5	12.76	65	10	11.15	115	30	11.07	110	30
150	14.21	100	30	13.36	150	30	13.19	140	30	12.42	125	25	11.21	115	35	11.08	125	30
200	13.20	200	45	12.78	150	35	12.58	185	35	12.02	125	35	11.08	115	40	11.01	115	30
300	12.09	225	55	11.68	225	45	11.96	225	40	11.48	175	35	10.96	150	35	10.96	125	35
400	11.50	275	55	11.16	275	50	11.40	225	45	11.12	200	50	10.86	150	40	10.65	225	40
500	11.16	275	55	12.02	225	50	11.38	250	50	10.74	250	50	10.54	180	50	10.42	250	50
600	11.50	275	50	12.61	200	35	12.02	—	30	10.56	275	60	10.27	225	60	10.23	275	55
800	**12.50**	**215**	**50**	**12.72**	**200**	**35**	**12.21**	**200**	**30**	**11.35**	275	**50**	10.04	250	60	9.74	275	60
1000	..	..	..	12.21	225	35	12.02	225	30	10.89	**250**	55	9.76	235	60	9.08	275	60
1200	..	..	..	11.68	225	40	11.52	235	45	10.71	275	55	8.34	240	65	..	..	..
1500	..	..	..	7.83	300	65	10.20	250	50	7.45	300	70	6.12	250	80	..	..	..
2000	..	..	..	..	..	..	..	..	..	4.55	350	70	3.82	250	80	..	..	..
2500	..	..	..	..	..	..	..	..	..	..	..	..	3.25	275	90	..	..	..
3000	..	..	..	..	..	..	..	..	..	..	..	..	2.89	290	95	..	..	..
3500	..	..	..	..	..	..	..	..	..	..	..	..	2.65	290	95	..	..	..
4000	..	..	..	..	..	..	..	..	..	..	..	..	2.60	290	95	..	..	..

Tab. 5. Indian Ocean.

	St. 3844 12°05′S 96°45′E 10-10-1929			St. 3828 1°53′N 96°07′E 18-9-1929			St. 3906 4°26′N 85°22′E 20-11-1929			St. 3920 1°05′S 62°25′E 9-12-1929			St. 3946 3°25′S 43°02′E 3-1-1930			St. 3962 24°44′S 38°31′E 14-1-1930		
Depth m.	t	N_2	P_2O_5	t	N_2	P_2O_5	t	N_2	P_2O_5	t	N_2	P_2O_5	t	N_2	P_2O_5	t	N_2	P_2O_5
0	25.20	30	0	27.78	2	0	28.80	0	5	30.37	0	0	26.65	0	0	26.50	0	0
10	25.24	5	0	27.81	2	0	28.00	0	5	28.72	0	0	26.60	0	0	25.98	2	5
25	25.24	8	0	27.81	0	0	27.97	0	15	27.54	0	0	26.11	0	5	25.92	0	5
50	25.24	2	0	27.89	0	5	27.88	5	15	26.01	2	15	25.50	8	5	24.82	0	10
75	24.91	15	5	27.31	10	10	22.27	225	70	23.74	110	30	25.21	30	15	23.94	15	10
100	24.70	30	15	23.50	160	50	19.62	350	85	20.83	275	65	25.21	25	15	23.03	40	15
150	21.74	175	50	13.74	400	125	14.36	450	110	15.67	300	90	17.33	165	60	20.66	(40)	(25)
200	17.14	225	80	12.80	400	125	13.05	450	110	14.42	300	90	13.22	200	70	19.73	40	30
300	11.04	450	120	11.87	425	135	12.25	500	150	11.27	325	100	11.30	250	80	15.46	135	50
400	9.53	475	120	10.56	450	140	11.06	500	150	10.00	425	125	9.98	325	110	13.84	125	50
500	8.76	550	140	9.80	550	150	10.47	500	160	9.34	450	160	9.66	350	110	12.56	165	50
600	7.90	600	140	9.12	550	160	9.55	550	170	8.82	500	175	9.24	400	140	11.38	175	50
800	6.42	600	150	7.91	550	175	8.01	550	170	7.91	500	175	8.63	450	165	9.60	(350)	(75)
1000	5.46	600	150	6.86	550	170	6.60	550	170	6.70	600	175	7.84	525	170	7.23	450	100
1200	4.60	600	150	5.78	550	155	5.66	550	170	5.67	550	175	6.69	550	170	6.18	500	130
1500	3.71	600	150	4.69	550	155	4.49	550	170	4.44	500	160	5.23	550	170	4.17	500	140
2000	2.74	600	145	2.74	550	155	2.92	550	170	2.85	525	160	3.40	550	170	2.90	500	130
2500	2.06	600	140	2.16	550	155	2.19	550	170	2.24	550	160	..	..	..	2.46	450	120
3000	1.68	600	130	1.73	550	155	1.80	550	170	1.82	550	170	..	..	..	..	..	..
3500	1.44	600	130	..	..	..	1.61	550	170	1.64	550	175	..	..	..	..	..	..
4000	..	..	..	..	..	..	..	..	..	1.51	525	175	..	..	..	..	..	..
4500	..	..	..	..	..	..	..	..	..	1.37	550	145	..	..	..	..	..	..

Tab. 6. Pacific Ocean.

	St. 3558 0°18′.1S 99°07′W 18-9-1928			St. 3563 7°45′.5S 131°24′W 29-9-1928			St. 3585 7°34′S 167°03′W 31-10-1928			St. 3642 46°40′S 176°09′E 9-1-1929			St. 3751 3°40′N 137°40′E 12-7-1929			St. 3719 20°51′N 124°54′E 25-5-1929		
Depth m.	t	N_2	P_2O_5	t	N_2	P_2O_5	t	N_2	P_2O_5	t	N_2	P_2O_5	t	N_2	P_2O_5	t	N_2	P_2O_5
0	19.10	150	50	25.88	40	20	28.46	5	15	13.48	85	15	28.40	0	0	29.00	0	0
10	18.63	150	60	25.88	40	30	28.48	5	15	12.70	95	40	28.38	0	0	28.54	0	0
25	18.02	175	70	25.86	40	30	28.46	5	15	12.63	110	40	28.58	0	10	28.27	0	0
50	17.36	175	70	25.84	40	30	28.44	5	15	9.90	150	60	28.63	15	15	27.97	0	0
75	16.35	175	80	25.83	40	30	28.42	5	15	7.65	200	80	27.76	45	30	26.83	0	0
100	14.09	175	90	25.70	40	30	27.58	35	20	6.84	200	80	26.73	85	35	26.44	0	0
150	13.11	225	100	20.83	50	30	25.95	65	30	6.65	200	80	23.44	115	40	25.14	0	0
200	12.46	350	125	16.00	150	60	23.18	80	30	6.78	200	80	19.18	150	65	23.45	0	0
300	11.53	475	160	11.06	275	90	14.01	275	70	6.66	225	80	11.86	350	110	18.03	70	20
400	9.40	500	160	9.32	275	90	9.03	450	90	6.15	275	100	8.50	525	145	14.50	175	50
500	7.63	500	160	8.22	350	125	8.13	500	90	5.90	275	115	7.74	500	135	10.94	350	80
600	7.08	500	160	7.18	400	125	6.96	500	90	5.52	300	115	7.20	550	135	8.76	425	115
800	5.68	500	160	5.62	400	125	5.76	500	110	4.05	350	130	5.94	600	150	5.54	450	165
1000	4.50	500	160	4.56	375	150	4.74	550	125	3.23	400	140	4.68	600	175	4.25	500	165
1200	3.84	500	160	3.80	400	160	4.01	550	175	2.88	450	140	3.90	600	180	3.41	500	165
1500	3.07	500	160	3.02	375	160	3.10	550	185	2.60	450	140	3.10	600	180	..	..	..
2000	2.32	500	175	2.32	400	150	2.26	550	150	2.24	500	140	2.40	600	165	..	..	..
2500	1.96	500	175	1.95	375	140	1.92	550	150	..	..	..	1.86	550	165	..	..	..
3000	1.77	500	175	1.78	400	125	1.68	550	150	..	..	..	1.65	600	165	..	..	..
3500	..	..	..	1.56	375	125	1.56	550	150	..	..	..	1.60	600	165	..	..	..
4000	..	..	..	1.44	400	125	1.44	550	150	..	..	..	..	..	..	..	..	..
4500	..	..	..	1.45	375	125	1.32	550	150	..	..	..	..	..	..	..	..	..

Tab. 7. Nitrates.

	Mediterranean		Atlantic Ocean		Indian Ocean		Pacific Ocean		Atlantic Ocean		Indian Ocean		Pacific Ocean	
Depth m.	M_1 Min.	M_2 Max.	A_1 Min.	A_2 Max.	I_1 Min.	I_2 Max.	P_1 Min.	P_2 Max.	A_1/M_1 Min.	A_2/M_2 Max.	I_1/M_1 Min.	I_2/M_2 Max.	P_1/M_1 Min.	P_2/M_2 Max.
0	0	75	0	20	0	30	0	150	—	0.3	—	0.4	—	2
10	0	45	0	5	0	5	0	150	—	0.1	—	0.1	—	3
25	0	90	0	15	0	8	0	175	—	0.2	—	0.1	—	2
50	0	80	0	100	0	8	0	175	—	1	—	0.1	—	2
75	0	85	0	250	10	225	0	200	—	3	∞	3	—	2
100	0	85	5	275	25	350	0	200	∞	3	∞	4	—	2
150	0	125	60	275	40	450	0	225	∞	2	∞	4	—	2
200	5	125	115	350	40	450	0	350	23	3	8	4	0	3
300	10	140	125	425	135	500	70	475	12	3	14	4	7	3
400	10	150	150	525	125	500	175	525	15	4	12	3	18	4
500	15	145	180	500	165	550	275	500	12	3	11	4	18	3
600	20	175	200	525	175	600	300	550	10	3	9	3	15	3
800	70	160	200	550	350	600	350	600	3	3	5	4	5	4
1000	75	200	225	525	450	600	375	600	3	3	6	3	5	3
1200	80	175	225	500	500	600	400	600	3	3	6	3	5	3
1500	80	175	250	475	500	600	375	600	3	3	6	3	5	3
2000	80	160	250	425	500	600	400	600	3	3	6	4	5	4
2500	80	150	275	375	450	600	375	550	3	2	6	4	5	4
3000	80	150	290	375	550	600	400	600	4	2	7	4	5	4
3500	90	150	290	375	550	600	375	600	3	2	6	4	4	4
4000	80	85	290	375	..	..	..	..	4	4	..	..	..	..

Tab. 8. Phosphates.

	Mediterranean		Atlantic Ocean		Indian Ocean		Pacific Ocean		Atlantic Ocean		Indian Ocean		Pacific Ocean	
Depth m.	M_3 Min.	M_4 Max.	A_3 Min.	A_4 Max.	I_3 Min.	I_4 Max.	P_3 Min.	P_4 Max.	A_3/M_3 Min.	A_4/M_4 Max.	I_3/M_3 Min.	I_4/M_4 Max.	P_3/M_3 Min.	P_4/M_4 Max.
0	0	5	0	15	0	5	0	50	—	3	—	1		10
10	0	0	0	10	0	5	0	60	—	∞	—	∞	—	∞
25	0	0	0	10	0	15	0	70	—	∞	—	∞	—	∞
50	0	15	0	20	0	15	0	70	-	1	—	1	—	5
75	0	10	0	70	5	70	0	80	—	7	∞	7	·	8
100	0	15	0	80	15	85	0	90	—	5	∞	6	·	6
150	0	20	15	90	25	125	0	100	∞	4	∞	6	—	5
200	0	25	20	100	30	125	0	125	∞	4	∞	5	—	5
300	0	25	35	130	50	150	20	160	∞	5	∞	6	∞	6
400	0	25	40	135	50	150	50	160	∞	5	∞	6	∞	6
500	0	30	50	150	50	160	80	160	∞	5	∞	5	∞	5
600	0	30	30	150	50	175	90	160	∞	5	∞	6	∞	5
800	5	30	30	150	75	175	110	165	6	5	15	6	22	6
1000	10	30	30	135	100	175	125	165	3	4	10	6	12	6
1200	10	30	40	135	130	175	140	175	4	4	13	6	14	6
1500	10	35	50	110	140	170	140	185	5	3	14	5	14	5
2000	5	30	70	100	130	170	140	175	14	3	26	6	28	6
2500	5	25	90	95	120	170	140	175	18	4	24	7	28	7
3000	5	25	95	95	130	170	125	175	19	4	26	7	25	7
3500	5	25	95	95	130	170	125	165	19	4	26	7	25	7
4000	5	10	95	..	..	175	..	..	19	..	..	..	..	..

Tab. 9.

	Banda Sea			Celebes Sea			Sulu Sea			Mindanao Sea			South China Sea			Caribbean Sea		
	St. 3676 5°47′S 131°14′E Depth: 7100 m. 22-3-1929			St. 3683 4°03′N 123°26′E Depth: 4950 m. 2-4-1929			St. 3685 7°23′N 121°22′E Depth: 4825 m. 4-4-1929			St. 3736 9°17′N 123°58′E Depth: 1770 m. 28-6-1929			St. 3689 7°13′N 111°43′E Depth: 1920 m. 9-4-1929			St. 3547 11°00′N 77°40′W Depth: 2825 m. 24-8-1928		
Depth m.	t	N_2	P_2O_5	t	N_2	P_2O_5	t	N_2	P_2O_5	t	N_2	P_2O_5	t	N_2	P_2O_5	t	N_2	P_2O_5
0	28.90	0	20	28.60	0	5	27.08	0	0	29.70	0	0	30.92	0	0	27.61	0	0
10	28.67	2	20	28.47	0	10	26.93	0	5	29.00	0	0	28.07	0	5	27.64	0	0
25	28.47	0	20	28.15	0	10	25.54	18	15	28.66	0	0	27.36	0	10	27.63	2	0
50	28.09	2	25	26.99	0	15	23.37	80	30	27.64	10	10	26.54	2	10	22.57	35	0
75	25.93	70	40	26.05	0	15	23.41	100	30	26.28	55	25	23.79	40	20	19.75	125	15
100	25.60	75	45	24.46	60	20	20.93	300	65	23.23	160	40	20.54	100	50	17.82	125	15
150	21.06	200	80	18.44	110	50	16.69	350	90	16.71	350	90	16.33	175	70	16.26	175	25
200	16.18	400	100	16.46	125	80	14.56	450	115	14.48	450	115	14.94	250	90	14.87	275	40
300	11.39	550	100	12.13	300	100	12.70	500	125	12.80	450	115	11.40	400	125	—	—	—
400	9.16	600	110	9.55	450	135	11.47	550	125	12.42	450	120	9.98	450	140	8.56	400	100
500	8.02	600	125	7.77	500	135	10.82	550	135	12.20	450	120	8.86	500	150	—	—	—
600	7.10	600	135	7.20	550	145	10.52	550	135	12.02	450	130	7.69	550	150	7.05	400	110
800	5.66	600	140	5.71	550	145	10.18	550	135	11.90	450	120	5.90	500	160	5.70	400	95
1000	5.02	600	140	4.70	550	165	10.11	550	135	11.79	450	120	4.64	550	160	—	—	—
1200	4.34	600	150	4.14	550	165	10.10	550	135	11.72	450	120	3.67	550	160	4.95	350	65
1500	4.64	600	160	3.92	550	165	10.12	550	135	11.70	450	135	2.98	550	160	4.26	350	50
2000	3.30	600	155	3.66	575	165	10.14	550	135	..	..	..	2.62[3]	550	160	..	..	..
2500	3.13	600	155	3.60	550	170	10.20	550	135	..	..	..	..	..	..	..	..	..
3000	3.11	600	165	3.60	550	170	10.28	550	130	..	..	..	..	..	..	..	..	..
3500	—	600	155	3.61	550	170	10.36	550	130	..	..	..	..	..	..	..	..	..
4000	3.16	600	150	3.64	550	170	10.42	550	130	..	..	..	..	..	..	..	..	..
5000	3.31	600	145	3.74[1]	550	170	10.56[2]	550	130	..	..	..	..	..	..	..	..	..
6000	3.42	600	140	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
7000	3.58	600	150	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

[1]) 4900 m. [2]) 4750 m. [3]) 1850 m.

REPORT ON THE DANISH OCEANOGRAPHICAL EXPEDITIONS 1908—10
TO THE MEDITERRANEAN AND ADJACENT SEAS
Vol. III. Miscellaneous Papers.

7.

Some quantitative investigations on the bottom fauna at the west coast of Italy, in the Bay of Algiers, and at the coast of Portugal

by

R. Spärck.

Published October 15., 1931.

Since long ago the scantity of the Mediterranean fauna has been acknowledged. Already in his book of travels C. Vogt expresses his astonishment at the great contrast between the rich fauna of Brittany and the poor fauna of the Mediterranean. He believes this to be due to the different kinds of rocks of the coasts and supposes that the scantity of the Mediterranean fauna must be referred to the calcareous mountains of the coasts of this sea, whereas the granite of Brittany is the cause of the richness of its fauna. Also as regards the pelagic fauna the scantity of the Mediterranean fauna was some time ago stated through the Danish oceanographic expeditions under the leadership of Prof. Johs. Schmidt. As regards the bottom fauna no thorough quantitative investigations have as yet been undertaken, wherefore it was with great pleasure that the present author accepted Prof. Johs. Schmidt's kind invitation to make such investigations during the stay of the research vessel "Dana" in the Mediterranean on its return from the circumnavigation expedition in May—June 1930. I beg to express my very best thanks to Prof. Schmidt and to the scientific staff of the expedition for their hospitality and assistance during my stay onboard.

On account of the very limited time which was at my disposal this little investigation must be regarded as quite preliminary. Considering the fact that no publication concerning such investigations in the Mediterranean has as yet appeared it will nevertheless be of some interest. The investigation was carried out in 4 localities, two in the Mediterranean, viz. on the West coast of Italy, off Naples and Salerno, and in the bay of Algiers, and for the sake of comparison in two localities outside of the Mediterranean, viz. at the South coast of Portugal at Faro and off Lisbon. Off Naples-Salerno 32 samples in all were taken with Petersen's 0.2 square metre bottom sampler, at Algiers 9 samples, and at Portugal likewise 9 samples, 4 off Faro and 5 off Lisbon.

If we begin by looking at the quantitative result proper, so striking a difference appears between the Mediterranean on one side and the coast of Portugal on the other side that it can by no means be ascribed to accidental circumstances.

5 samples from off Positano in depths of 19—875 m. contained of an average 2.8 g. live animals per sq. m. (Table I).

9 samples taken off Pæstum from depths of 9—220 m. contained of an average 6.5 g. per sq. m. (Table I).

3 samples taken at Sorrento in a depth of 90 metres were found to contain of an average 0.9 g. live animals per sq. m. (Table II).

6 samples taken at Castellamare in a depth of 13—85 m. contained of an average 13.9 g. per sq. m. (Table II).

9 samples from between Capri and Naples in depths of 18—1030 m. contained of an average 4.4 g. per sq. m. (Table II).

This makes on an average 6 g. of live animals per sq. m. at the coast of Italy. The greatest value was 60.9 g. per sq. m. (off Castellamare 25 m.), whereas two samples of the 32 (from respectively 225 and 1030 m. off Naples) contained no live specimens at all.

If we compare with the samples from the bay of Algiers, the 9 samples from there, (taken in depths of 13—400 m.) appear to contain of an average 18.7 g. of live animals; the richest contents amounting to 60.4 g. per sq. m., the scantiest to 0.5 g. per sq. m. Thus we see that the animals are somewhat more numerous at Algiers than at the coast of Italy.

If then we turn to the samples from the South coast of Portugal (from 32 to 95 m. depths) the result is quite different as the contents are of an average 266.4 g. of live animals per sq. m (Table IV). A single

sample presented 974.4 g. per sq. m., the others respectively 55.9, 31.1 and 9 g. Also the samples from off Lisbon (Table V) contained much greater values than the corresponding results from the Mediterranean; 3 samples from soft bottom contained respectively 95.7, 90.3, and 11.5 g., which make an average of abt. 65 g. 2 samples with epifauna as might be expected contained much higher values of up to 2.500 g. per sq. m (Table VI).

If we look at the number of species and specimens within the above mentioned regions we come to the same result. The greatest numbers are from the coast of Portugal, the smallest from the coast of Italy. From Naples and Salerno the average number of species per sample amounts to 6—7, with abt. 11 species in a single sample as maximum. From Algiers an average number of abt. 10 species per sample has been stated, with 16 species as maximum, and off Faro abt. 20 species have been found in the samples, and a maximum of 24.

In quite a similar way we find an average number of specimens per sq. m. of abt. 50 (maximum 220) at the coast of Italy, at Algiers of abt. 100 (maximum 500), and at Faro of abt. 200 (maximum 665).

From the above statements it may become evident that, as regards the weights of live animals as well as the number of species and specimens, a considerable decrease is taking place from the coast of Italy towards the Strait of Gibraltar, so that the greatest values are to be found outside the Strait of Gibraltar, in the Gulf of Cadiz, much less values at Algiers, and still less at the coast of Italy.

From a comparison with the numbers from the coast of Italy it appears that these latter are not only smaller than those from the Gulf of Cadiz but also much below the numbers stated from most of the northern waters in which such investigations have been undertaken. In the North Sea, the Skagerrak, and the adjoining Danish waters, in which quantitative investigations of the bottom fauna have been carried out for a long series of years by the Danish Biological Station, the bottom fauna quantitatively by far surpasses that stated through the samples from the coast of Italy and the Bay of Algiers. A series of samples from the Skagerrak from depths between 15 and 90 m. (corresponding to the majority of the samples from the Mediterranean) were found to contain live animals of an average to an amount of abt. 450 g. per sq. m. (Petersen 1915, p. 26). The number of species taken in the same samples was 10—20, and the number of specimens was very great, not less than 60—70, in a few of the samples up to 1000. A series of samples from the deep parts (150—700 m.) of the Skagerrak (Petersen l. c.) also present much greater values than those found in the Mediterranean, an average content of above 100 g. of live animals per sq. m. Quite similar, high values appear from investigations from the Oslo Fjord (Petersen l. c.), the Gullmar Fjord (Molander 1928) and the Kattegat (Petersen 1913, Blegvad 1930), as the contents of live animals in these waters with a level, soft bottom most often amount to more than 100 g. per sq. m., frequently up to 400—500 g. Even in a brack water region such as the Baltic Sea proper we find contents of live animals (Petersen 1913, Thulin 1922, Hessle 1925, Hagmeier 1930) quantitatively exceeding those found in the Mediterranean. As thus a quantitatively much richer fauna than that of the Mediterranean has been stated in the deeper and more open northern waters it is only natural that in fjord regions with lower water, as f. inst. The Zuider Sea (Havinga 1922) or the Limfjord (Boysen Jensen 1919, Spärck & Lieberkind 1921, Blegvad 1928) the number of animals per sq. m. may be found to surpass up to a hundred times the numbers stated from the Mediterranean investigations. Corresponding results are obtained by the quantitative investigations undertaken in the other North European waters, as f. inst. the South part of the North Sea (Hagmeier 1925), in Faroese or Icelandic waters (Spärck 1929) and in the Barents Sea (Zenkewitsch 1927). Also in these waters we most often find on the level sea bottom a quantity of living animals of several hundred g. per sq. m., the number of specimens as well as of species likewise per unit area by far surpassing the numbers taken in the Mediterranean.

From these few and previous investigations so great a difference in the quantity of the fauna thus appears between the Mediterranean on one side and the West and North European waters on the other side, that this fact, as before mentioned, can hardly be due to accidental circumstances. Anywhere along the West

coast of Europe, from Iceland to the Gulf of Cadiz, we find on the level sea bottom, in depths of 20—100 m., most often 200—300 g. of live animals; in the Mediterranean the corresponding number is at the coast of Italy and of Algiers, as before mentioned, 6 and abt. 20 g. respectively. That the great difference in these numbers is proof of a real difference in the quantity of the fauna seems exceedingly probable. It is in accordance with the results obtained through the investigation of the pelagic fauna carried out, and it likewise agrees well with the spontaneous impression produced on an observer of one of the coasts of the Mediterranean. The scantity of the fauna is finally in good agreement with the fact that the fishing of bottom fish in the Mediterranean is — in contrast to that in the coastal waters of the Atlantic — most insignificant.

In order to find an explanation of the scantity of the Mediterranean fauna it will be most suitable first of all to think of seeking it in the conditions of food. As first proof of this we shall mention the fact that the scantity applies to the whole of the fauna, the pelagic as well as the bottom fauna. Further that the scantity is less striking in localities with a supply of nourishment. Some of the richest of the 41 Mediterranean samples originate from the mouth of a river (St. 4106 off the mouth of Sele), and from the mouths of two harbours (St. 1416—17 off Naples, St. 4134, off Algiers), which also serve to emphasize that it is the problem of nourishment which is of vital importance to the scantity of the fauna of the Mediterranean.

In this connection it ought also to be pointed out that the vegetation of sea-grasses and algae along the coasts of the Mediterranean is extremely scanty, when compared with that of the Atlantic, i. e. one more proof of the scantity of the nourishment of the Mediterranean. Of immense importance to the solving of this problem finally are the investigations of the contents of nitrate-phosphate in the water, which were carried out by the Dana-Expedition during its stay in the Mediterranean in April—June 1930. From these it appeared that the contents of nitrate-phosphate in the sea water are very scanty compared with those of the Atlantic (Thomsen 1931) which fact fully explains the scantity of the vegetation of the Mediterranean and thus also that of the fauna. This further implies the probability of the before mentioned hypothesis that the scantity of the Mediterranean fauna is mainly due to bad food conditions.

If we then look at the qualitative result, it is, of course, not possible to draw any decisive conclusions from this small investigation. I shall, however, point out some noticeable features and as for the rest refer to the tables. Thus it is a striking fact that crustacea are much more predominant in the Mediterranean than in the North- and West-European waters. This is certainly due to the scantity of food in the Mediterranean, in that quick carnivorous animals as crustacea will much better be able to compete under bad conditions of food than the microorganism- and detritusfeeding lamellibranchiata and annelidæ, which are furthermore practically sedentary. Particularly striking is the fact, that the only one of the 41 samples from the Mediterranean, in which lamellebranchiata are dominating, is the very sample off the mouth of the river Sele.

Concerning the predominating animals of the samples it appears from the tables, that *Amphiura filiformis* and *A. chiajei* as well as *Turritella terebra* quite in likeness with the eastern part of Kattegat and other northern waters also predominate on soft bottom in the Bay of Algiers. On soft bottom of the coastal waters of the Mediterranean as well as off the coast of Portugal *Sternaspis* is dominating just as in the fjords of the Faroes and Iceland on the same bottom and at the same depths. In quite similar manner the lamellibranchiata genera *Venus* and *Syndosmya* (*Abra*) predominate as they do on respectively sandy and soft bottom off the North European coasts.

The difference between the fauna of the level sea bottom of the Mediterranean and that of North European water seems according to this small investigation to be in the main quantitative and not qualitative. And it further seems to confirm the conception formerly put forth by the present author (Spärck 1926) that the food-conditions are factors of great zoogeographical importance.

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Table I. Contents of the samples from the Gulf of Salerno*).

Name of the species	St. 4106 **) Off the mouth of Sele 9 m. Sand	St. 4105 Off Pæstum 10 m. Sand	St. 4104 Off Pæstum 19 m. Clay & Sand	St. 4097 Off Positano 19 m. Sand	St. 4103 Off Pæstum 35 m. Clay & Sand	St. 4096 Off Positano 64 m. Clay & Sand	St. 4095 Off Positano 90 m. Clay with a little Sand	St. 4098 Off Amalfi 90 m. Clay	St. 4102 Off Pæstum 100 m. Clay	St. 4101 Off Amalfi 138 m. Clay	St. 4099 Off Amalfi 150 m.	St. 4100 Off Pæstum 220 m.	St. 4093 S.E. of Galli 610 m. Clay with lava gravel	St. 4092 S.W. of Capo Sottile 875 m. Clay
	Number & weight pr. sq.m.	Number & weight pr. sq.m.	Number & weight pr. sq.m.	Number & weight pr. sq.m.	Number & weight pr. sq.m.	Number & weight pr. sq.m.	Number & weight pr. sq.m.	Number & weight pr. sq.m.	Number & weight pr. sq.m.	Number & weight pr. sq.m	Number & weight pr. sq.m.	Number & weight pr. sq.m.	Number & weight pr. sq.m.	Number & weight pr. sq.m.
Syndosmya nitida	75-5 g.	..	..	..	..	..	..	..	..	..	..	..	..	..
Syndosmya sp.	..	..	..	..	..	..	..	..	..	..	..	5-0.05 g.	15-0.2 g.	5-0.05 g.
Cultellus pellucidus	130-5 g.	3-1 g.	..	..	..	..	..	..	..	..	..	..	..	..
Nucula nucleus	..	..	..	..	..	..	..	..	..	5-0.5 g.	..	..	..	..
Venus gallina	..	2-10.5 g.	..	..	..	..	..	..	..	..	..	..	..	..
Nassa sp.	..	..	..	..	..	..	..	..	..	..	..	..	5-1 g.	..
Dentalium sp.	..	..	..	..	..	..	..	..	..	..	..	..	15-2 g.	..
Jaxea nocturnea	..	..	..	..	..	..	..	..	5-5 g.	..	..	..	..	..
Gonoplax angulata	..	..	..	..	..	..	..	..	..	5-0.9 g.	..	..	..	..
Eupagurus sp.	..	..	..	..	..	5-05. g.	..	..	..	..	..	..	..	..
Cirolana cranchi	..	..	..	..	..	5-0.3 g.	..	..	..	..	..	..	..	..
Tritæta gibbosa	..	..	..	..	..	5-0.1 g.	..	..	..	..	..	..	..	..
Bathyporeia sp.	..	..	..	5-0.1 g.	..	..	..	..	..	..	..	..	..	..
Ampelisca tenuicornis	10-0.3 g.	..	..	..	..	..	..	..	..	..	..	..	..	..
Amphiura chiajei	..	..	..	5-0.5 g.	..	5-0.3 g.	..	..	..	..	..	..	..	..
Ophiopsila aranea	..	..	..	..	..	5-0.5 g.	5-5 g.	..	..	..	..	..	..	..
Astropecten jonstoni	..	3-13 g.	..	..	..	..	..	..	..	..	..	..	..	..
Echinocardium cordatum	..	..	5-9.5 g.	..	..	..	..	..	..	..	..	..	..	..
Genocidaris maculata	..	..	..	..	..	5-0.5 g.	..	..	..	..	..	..	..	..
Oestergrenia digitata	..	..	5-1 g.	..	..	..	..	..	..	..	..	..	..	..
Cucumaria elongata	..	..	..	..	..	..	5-0.5 g.	..	..	..	..	..	..	..
Sternaspis scutata	..	..	..	..	..	..	..	..	10-1 g.	..	..	..	..	..
Glycera sp.	..	..	..	..	..	..	..	..	..	..	5-0.15 g.	..	..	..
Polynoidæ	..	..	..	..	..	..	..	..	..	..	10-0.2 g.	..	..	..
Lumbriconereis sp.	..	..	..	..	..	..	5-0.3 g.	5-0.1 g.	..	..	..	..	..	..
Hyalinoecia sp.	..	..	..	..	..	..	..	5-0.2 g.	..	..	..	..	..	..
Eunicidæ	..	..	..	..	..	..	..	10-0.3 g.	..	..	..	..	..	..
Nephthys. sp.	..	..	..	..	5-1.5 g.	..	..	..	..	5-0.8 g.	..	..	..	..
Notomastus. sp.	..	..	..	..	10-0.5 g.	..	..	..	..	..	..	..	..	..
Ditrupa arietina	..	..	..	5-0.3 g.	..	..	..	..	..	..	..	..	..	..
Sipunculid	..	..	..	5-0.5 g.	..	..	..	..	..	..	..	..	..	..
Nemertes	5-0.3 g.	..	..	..	..	..	..	..	..	..	..	..	..	..

*) For the revision of the determinations of Echinoderms, Crustacea, Annelida & Bryozoa I am much indebted to Dr. Th. Mortensen, cand. mag. K. Stephensen, mag. sc. E. Wesenberg-Lund and Mr. S. G. Heding of the Museum of Copenhagen and to Dr. F. Borg, Uppsala.

**) The exact positions of stations will be published in a special report with all the stations of the "Dana" in the years 1928—30.

Table II. Contents of the samples from the Gulf of Naples.

Name of the species	St. 4087 Off Castellamare 13 m. Clay Number & weight pr. sq. m.	St. 4116 Off Villa Communale Naples 18 m. Sand Number & weight pr. sq. m.	St. 4117 Off Castel del Ovo Naples 24 m. Sand Number & weight pr. sq. m.	St. 4086 Off Castellamare 25 m. Clay Number & weight pr. sq. m.	St. 4115 Off Capo Posillipo 51 m. Clay Number & weight pr. sq. m.	St. 4088 Off Castellamare 64 m. Sand & Gravel Number & weight pr. sq. m.	St. 4114 Off Posilipo 78 m. Clay Number & weight pr. sq. m.	St. 4089 Off Castellamare 85 m. Clay Number & weight pr. sq. m.	St. 4083 Off Sorrento 93 m. Clay Number & weight pr. sq. m	St. 4082 Off Sorrento 101 m. Clay Number & weight pr. sq. m.	St. 4081 Off Sorrento 101 m. Clay Number & weight pr. sq. m.	St. 4090 Off Castellamare 115 m. Clay Number & weight pr. sq. m.	St. 4091 Off Castellamare 145 m. Clay Number & weight pr. sq. m.	St. 4113 Off Naples 150 m. Clay Number & weight pr. sq. m.	St. 4112 Between Capri and Naples 225 m. Clay Number & weight pr. sq. m.	St. 4110 N.W. of Capri 250 m. Clay Number & weight pr. sq. m.	St. 4111 N. of Capri 400 m. Clay Number & weight pr. sq. m.	St. 4109 S.W. of Capri 1030 m. Clay Number & weight pr. sq. m.
Syndosmya nitida	5-0.3 g.																		
Tellina donacina		5-0.3 g.	5-0.3 g.																
Turritella terebra		5-2.5 g.	5-1.5 g.	105-50 g.		5-2.5 g.													
Littorina neritoides		5-0.5 g.	5-1 g.																
Dentalium sp.																			
Calyptra chinensis		10-2 g.			5-1.2 g.	5-0.5 g.												5-2.5 g.	
Gonoplax angulata				5-5 g.		15-0.5 g.		15-1 g.	10-0.5 g.			10-0.5 g.							
Calocaris macandreæ						15-0.5 g.	5-0.15 g.	5-1 g.	10-0.5 g.										
Anapagurus lævis																			
Callianassa subterranea																			
Alpheus ruber																			
Athanas nitescens	5-0.15 g.																		
Apseudes echinatus			5-2.5 g.	10-0.3 g.															
Hippolytidæ																			
Ampelisca sp.	5-0.15 g.	20-0.1 g.					5-0.1 g.												
Ampelisca tenuicornis					10-1 g.														
Amphiura filiformis					5-1 g.														
Schizaster canalifera																			
Brissopsis lyrifera																			
fragm.																			
Sternaspis scutata					25-1 g.														
Nephthys sp.	5-1 g.	25-0.5 g.	10-1.5 g.	5-0.2 g.			5-5 g.	5-1 g.	5-0.3 g.										
Lumbriconereis sp.		5-0.1 g.			10-1 g.	5-0.1 g.	10-10 g.				5-0.5 g.								
Glycera sp.	5-0.5 g.		5-0.5 g.		5-0.5 g.														
Onuphis eremita		10-0.2 g.				10-0.2 g.													
Marphysa sp.		10-0.3 g.																	
Ditrupa arrietina	5-0.3 g.	10-2 g.																	
Maldanidæ																			
Polynoidæ	5-0.3 g.	10-0.5 g.		10-0.3 g.															
Eunicidæ			5-0.5 g.																
Sipunculid								5-0.3 g.											
Maldane glebifex									10-0.3 g.										
Nemertes				5-0.5 g.		5-0.2 g.	5-0.5 g.												
Planarian								5-0.5 g.											
Actinian												5-3.5 g.					5-0.3 g.		
															No living animals				No living animals

Table III. Contents of the samples from the Bay of Algiers.

Name of the species	St. 4126 13 m. Sand Number & weight pr. sq. m.	St. 4131 23 m. Clay Number & weight pr. sq. m.	St. 4127 26 m. Clay Number & weight pr. sq. m.	St. 4134 35 m. Clay Number & weight pr. sq. m.	St. 4132 50 m. Clay Number & weight pr. sq. m.	St. 4128 79 m. Clay Number & weight pr. sq. m.	St. 4133 111 m. Clay Number & weight pr. sq. m.	St. 4130 110 m. Clay Number & weight pr. sq. m.	St. 4129 400 m. Clay Number & weight pr. sq. m.
Corbula gibba	10-1 g.	..	10-0.8 g.	5-0.3 g.	..	10-1 g.	..	..	..
Syndosmya prismatica	..	..	20-0.3 g.	..	..	..	..	..	..
Cultellus pellucidus	..	..	5-0.1 g.	..	..	..	..	..	..
Nucula nucleus	..	..	..	5-0.3 g.	10-2 g.	5-2.5 g.	..	5-0.5 g.	..
Tellina donacina	..	..	5-0.3 g.	..	..	..	..	..	..
Gouldia minima	..	..	5-0.1 g.	..	..	..	..	..	..
Amphiura chiajei	5-0.4 g.	65-8 g.	100-8.5 g.	370-30 g.	55-5 g.	..	..	..	..
Amphiura filiformis	..	..	..	30-2.5 g.	1-0.1 g.	..	..	..	..
Upogebia littoralis	..	..	..	5-5 g.	..	..	..	..	..
Cirolana cranchi	..	..	..	20-2.5 g.	..	..	..	..	..
Pilumnus hirtellus	..	..	..	15-7.5 g.	..	..	..	..	..
Gonoplax angulata	..	..	5-6.4 g.	..	..	..	5-5 g.	..	..
Alphæus ruber	..	..	..	..	..	..	..	5-2.5 g.	..
Apseudes echinatus	..	..	..	..	..	..	..	5-0.3 g.	..
Ampelisca brevicornis	10-0.1 g.	..	20-0.4 g.	..	..	..	..	..	..
Ampelisca sp.	..	..	..	..	..	5-0.3 g.	..	..	..
Ampelisca typica	..	..	20-0.4 g.	..	..	..	..	..	..
Ampelisca tenuicornis	..	..	..	..	..	..	..	5-0.3 g.	..
Moera grossimana	..	..	..	5-0.3 g.	..	..	..	..	..
Oestergrenia sp.	..	..	..	..	..	..	20-10 g.	5-0.5 g.	..
Thyone fusus	..	..	..	5-7.5 g.	..	..	..	..	..
Sternaspis scutata	..	..	10-2 g.	..	..	20-0.3 g.	..	..	5-0.5 g.
Nephthys sp.	..	..	10-2 g.	5-1.5 g.	..	5-0.5 g.	..	..	..
Lumbriconereis sp.	..	5-0.5 g.	5-0.5 g.	..	..	10-0.5 g.	..	5-0.3 g.	..
Glycera sp.	..	5-0.5 g.	5-0.5 g.	5-1 g.	..	..	10-2.5 g.	..	..
Hyalinoecia sp.	..	5-0.5 g.	..	..	..	..	..	..	..
Nematonereis unicornis	..	..	5-0.5 g.	..	..	..	..	..	..
Cirratulus chrysoderma	..	5-0.5 g.	..	..	..	..	..	..	..
Euchone sp.	..	..	..	..	..	..	10-16 g.	..	..
Ditrupa arietina	..	..	20-2 g.	..	..	..	..	..	..
Maldanidæ	..	..	..	..	..	..	..	5-0.3 g.	..
Onuphis sp.	..	..	..	..	..	..	..	5-0.3 g.	..
Phyllodocidæ	..	..	..	15-1.5 g.	..	..	..	..	..
Theostoma oerstedi	..	..	..	5-1 g.	..	..	..	..	..
Nemertes	..	..	10-0.5 g.	..	10-1 g.	..	..	..	..
Balanoglossus sp.	..	5-1 g.	..	..	..	5-3 g.	..	..	..
Virgularia sp.	..	..	..	..	5-15 g.	..	..	..	..

Table IV. Contents of the samples off Faro, S. Portugal.

Name of the species	St. 4143 32 m. Sand & Gravel Number & weight pr. sq. m.	St. 4144 48 m. Sand with Clay Number & weight pr. sq. m.	St. 4145 75 m. Clay with shells Number & weight pr. sq. m.	St. 4146 95 m. Clay Number & weight pr. sq. m.
Syndosmya nitida	5-0.2 g.	..	5-0.3 g.	..
Tellina exigua	15-0.6 g.	..	..	..
Venus gallina	..	245-397.5 g.	..	..
Venus fasciata	20-1.5 g.	..	..	..
Dosinia lincta	5-1.5 g.	10-2 g.	..	..
Solen ensis	0-10 g.	..	..	..
Nucula nucleus	35-4 g.	20-4 g.	..	..
Corbula gibba	10-2.5 g.	80-12.5 g.	10-2.5 g.	..
Tellina planata	..	5-6 g.	..	..
Turritella terebra	..	160-120 g.	..	10-2 g.
Calyptra chinensis	5-1.5 g.	5-1 g.	..	..
Dentalium sp.	..	5-5 g.	..	..
Gonoplax angulata	..	10-4 g.	..	..
Amphiura chiajei	..	20-1 g.	15-5 g.	..
Amphiura filiformis	..	5-0.2 g.	10-4 g.	..
Ophiopsila annulosa	5-9 g.	..	..	..
Ophiura albida	10-1 g.	..	..	..
Echinocyamus pusillus	5-0.5 g.	..	..	..
Cucumaria elongata	..	5-4.5 g.	..	..
Leptosynapta macrankyra	..	..	5-0.5 g.	..
Sternaspis scutata	..	..	40-2.5 g.	..
Lumbriconereis sp.	30-4 g.	..	5-6 g.	5-0.5 g.
Nephthys sp.	..	5-1 g.	..	..
Hyalinoecia bilineata	65-1 g.	..	..	..
Hyalinoecia brementi	5-0.2 g.	..	..	..
Eunice oerstedi	10-0.5 g.	..	..	..
Stylarioides flabellata	20-1.5 g.	..	..	..
Mystides borealis	5-0.5 g.	..	..	..
Harmothoe lunulata	..	5-0.3 g.	..	..
Notomastus profundus	..	45-1 g.	5-0.3 g.	..
Eumenia crassa	..	..	..	5-2.5 g.
Owenia fusiformis	..	..	..	10-3 g.
Glycera sp.	5-0.8 g.	5-0.5 g.	..	..
Aspidosiphon sp.	5-4 g.	..	..	..
Maldanidæ	15-0.6 g.	..	25-5 g.	..
Sabellidæ	5-0.5 g.	..	..	..
Terebillidæ	10-5 g.	5-0.3 g.	20-2 g.	5-0.5 g.
Phyllodacidæ	..	5-0.5 g.	..	..
Cirratulidæ	..	10-0.8 g.	..	..
Polynoidæ	..	..	10-0.5 g.	..
Chætopteridæ	..	5-1 g.	..	..
Phascolion sp.	5-0.5 g.	..	..	..
Nemertes	10-9 g.	..	5-2.5 g.	5-0.5 g.
Pteroides griseus	..	5-410 g.	..	..
Amphioxus lanceolatus	..	10-1 g.	..	..

Table V. Contents of the samples off river Tagus.

Name of the species	St. 4153 50 m. Sand Number & weight pr. sq. m.	St. 4152 70 m. Clay Number & weight pr. sq. m.	St. 4151 108 m. Clay Number & weight pr. sq. m.
Syndosmya nitida	5-0.3 g.	..	..
Venus gallina	..	5-7.5 g.	5-1 g.
Thyasira sp.	5-0.4 g.	..	..
Nucula sp.	10-0.8 g.	..	..
Sipho sp.	..	..	15-10 g.
Dentalium sp.	10-8 g.	..	..
Eupagurus sp.	5-1 g.	5-0.8 g.	..
Ampelisca tenuicornis	..	5-0.1 g.	..
Brissopsis lyrifera	..	..	15-70 g.
Cucumaria elongata	..	5-5 g.	..
Hyalinoecia sp.	35-1 g.	15-0.5 g.	..
Sternaspis scutata	..	455-62.5 g.	5-0.5 g.
Owenia fusiformis	..	5-7.5 g.	..
Nephthys sp.	..	10-0.5 g.	..
Glycera sp.	..	5-0.5 g.	..
Lumbriconereis sp.	..	10-0.5 g.	..
Maldanidæ	..	10-0.3 g.	..
Edwardsia sp.	..	20-20 g.	..
Sagartia sp.	..	..	10-8 g.
Nemertes	..	..	10-0.8 g.

Table VI. Contents of the samples from the aestuary of river Tagus.

Name of the species	St. 4154 11 m. Gravel & shells Number & weight pr. sq. m.	St. 4155 15 m. Gravel & shells Number & weight pr. sq. m.
Smittina foliacea	∞ ab 2500 g.	∞ ab 2500 g.
Porcellana longicirrus	110-14 g.	70-4.5 g.
Pilumnus hirtellus	10-2 g.	10-2.5 g.
Xantho sp.	10-4 g.	..
Lysianassa ceratina	5-1 g.	..
Lysianassa longicornis	5-1 g.	..
Ebalia cranchi	5-1 g.	..
Galathea sp.	..	5-0.5 g.
Apseudes talpa	..	5-1 g.
Spirontocaris cranchi	10-0.5 g.	..
Alphæus megachiles	10-3.5 g.	..
Gastrosaccus sp.	5-0.05 g.	..
Eurysteus erythrophthalmus	10-1 g.	..
Corophium bonelli	10-1 g.	..
Ophiothrix fragilis	10-10 g.	5-4 g.
Onos maculata	5-4 g.	..
Amphitrite sp.?	70-10 g.	..
Eulalia sp.	10-0.5 g.	..
Marphysa sanguinea	5-0.3 g.	..
Lepidonotus clava	5-0.8 g.	..
Lepidonotus squamatus	10-1 g.	..
Bonellia sp.?	5-4 g.	..

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